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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics.*

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Includes space-based development of products and processes for commercial application.

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Includes engineering (general); communications and radar; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

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For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

77 THERMODYNAMICS AND STATISTICAL PHYSICS 3088
Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law, political science, and space policy; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 3089
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 3089
Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW, POLITICAL SCIENCE AND SPACE POLICY 3091
Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 3091
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) 3091

89 ASTRONOMY 3092
Includes radio, gamma-ray, and infrared astronomy; and astrometry.

90 ASTROPHYSICS 3093
Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.
For related information see also *75 Plasma Physics.*

91 LUNAR AND PLANETARY EXPLORATION 3094
Includes planetology; and manned and unmanned flights.
For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance.*

92 SOLAR PHYSICS 3095
Includes solar activity, solar flares, solar radiation and sunspots.
For related information see *93 Space Radiation.*

93 SPACE RADIATION 3096
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs.

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

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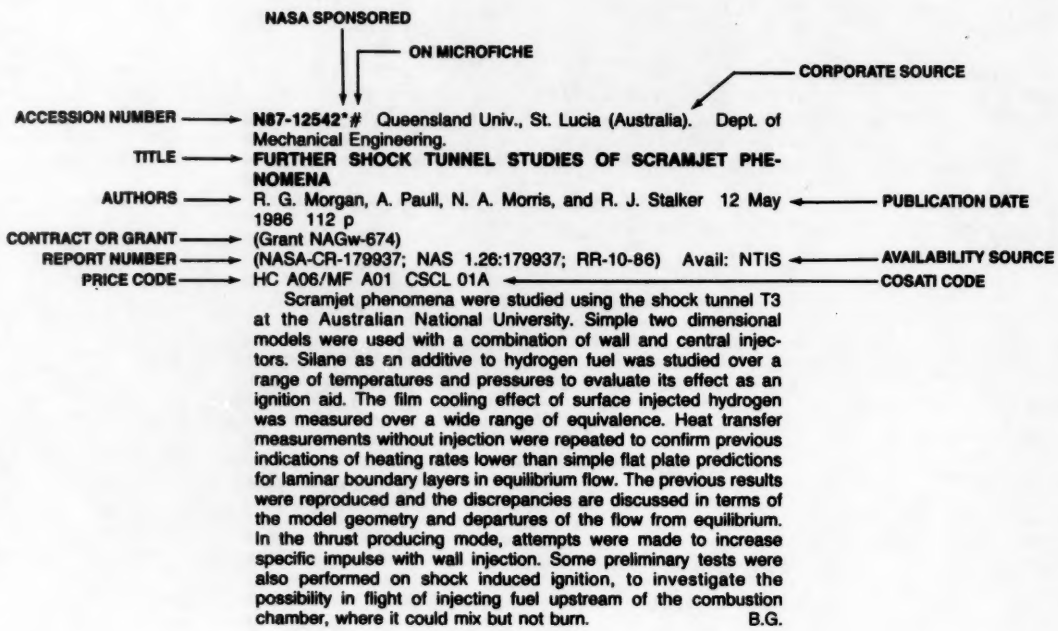
TYPICAL CITATION AND ABSTRACT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CORPORATE SOURCE
ACCESSION NUMBER
N87-12542*# Queensland Univ., St. Lucia (Australia). Dept. of Mechanical Engineering.
TITLE
FURTHER SHOCK TUNNEL STUDIES OF SCRAMJET PHENOMENA
AUTHORS
R. G. Morgan, A. Paull, N. A. Morris, and R. J. Stalker 12 May 1986 112 p
PUBLICATION DATE
CONTRACT OR GRANT
(Grant NAGw-674)
REPORT NUMBER
(NASA-CR-179937; NAS 1.26:179937; RR-10-86) Avail: NTIS
AVAILABILITY SOURCE
PRICE CODE
HC A06/MF A01 CSCL 01A
COSATI CODE
Scramjet phenomena were studied using the shock tunnel T3 at the Australian National University. Simple two dimensional models were used with a combination of wall and central injectors. Silane as an additive to hydrogen fuel was studied over a range of temperatures and pressures to evaluate its effect as an ignition aid. The film cooling effect of surface injected hydrogen was measured over a wide range of equivalence. Heat transfer measurements without injection were repeated to confirm previous indications of heating rates lower than simple flat plate predictions for laminar boundary layers in equilibrium flow. The previous results were reproduced and the discrepancies are discussed in terms of the model geometry and departures of the flow from equilibrium. In the thrust producing mode, attempts were made to increase specific impulse with wall injection. Some preliminary tests were also performed on shock induced ignition, to investigate the possibility in flight of injecting fuel upstream of the combustion chamber, where it could mix but not burn. B.G.

VOLUME 25 NUMBER 22 / NOVEMBER 23, 1987

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N87-27596*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
JOINT UNIVERSITY PROGRAM FOR AIR TRANSPORTATION RESEARCH, 1985
Frederick R. Morrell, comp. Jul. 1987 100 p Conference held in Atlantic City, N.J., 30 Jan. 1986
(NASA-CP-2453; NAS 1.55:2453; NAS) Avail: NTIS HC A05/MF A01 CSCL 01B

Air transportation research being carried on at the Massachusetts Institute of Technology, Princeton University, and Ohio University is discussed. Global Positioning System experiments, Loran-C monitoring, inertial navigation, the optimization of aircraft trajectories through severe microbursts, fault tolerant flight control systems, and expert systems for air traffic control are among the topics covered. For individual titles, see N87-27597 through N87-27607.

N87-27597*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
INVESTIGATION OF AIR TRANSPORTATION TECHNOLOGY AT MASSACHUSETTS INSTITUTE OF TECHNOLOGY, 1985 **c03**
Robert W. Simpson *In* NASA, Langley Research Center, Joint University Program for Air Transportation Research, 1985 Jul. 1987 p 3-6 (For primary document see N87-27596 22-01)
Avail: NTIS HC A05/MF A01 CSCL 01C

Two areas of research are discussed, an investigation into runway approach flying with Loran C and a series of research topics in the development of experimental validation of methodologies to support aircraft icing analysis. Flight tests with the Loran C led to the conclusion that it is a suitable system for non-precision approaches, and that time-difference corrections made every eight weeks in the instrument approach plates will produce acceptable errors. In the area of aircraft icing analysis, wind tunnel and flight test results are discussed. Author

N87-27598*# Massachusetts Inst. of Tech., Cambridge.
EXPERIMENTAL METHODOLOGIES TO SUPPORT AIRCRAFT ICING ANALYSIS **c03**
R. John Hansman, Jr. and Mark S. Kirby *In* NASA, Langley Research Center, Joint University Program for Air Transportation Research, 1985 Jul. 1987 p 7-25 (For primary document see N87-27596 22-01)
Avail: NTIS HC A05/MF A01 CSCL 01C

The experimental methodologies are illustrated by graphs, charts and line drawings. Typical ultrasonic echo signals for dry and wet ice growth, ice accretion rates for various tunnel configurations, the experimental configuration for flight tests of the ultrasonic measuring system and heat balance models used to predict ice growth are among the topics that are illustrated and briefly discussed. R.J.F.

N87-27599*# Ohio Univ., Athens.
GPS EXPERIMENTS **c04**
Samuel J. P. Laube *In* NASA, Langley Research Center, Joint University Program for Air Transportation Research, 1985 Jul. 1987 p 31-41 (For primary document see N87-27596 22-01)
Avail: NTIS HC A05/MF A01 CSCL 17G

A method of collecting positional data has been devised using the Federal Aviation Administration (FAA) receiver built by Lincoln Labs which was originally designed for service as a long-term monitoring station. Modification of the receiver continues and this will allow its use as an aircraft navigator. Additional effort has been spent on the development of an experimental receiver or test bed receiver that would allow modification and implementation of new Global Positioning System (GPS) receiver design concepts. Author

N87-27600*# Ohio Univ., Athens.
LORAN-C MONITORING **c04**
Jamie Edwards *In* NASA, Langley Research Center, Joint University Program for Air Transportation Research, 1985 Jul. 1987 p 39-41 (For primary document see N87-27596 22-01)
Avail: NTIS HC A05/MF A01 CSCL 17G

The Loran-C monitor developed by Ohio University will collect Loran signal data for storage on magnetic tape. Stationed at the Ohio University Airport, Athens, Ohio, the monitor will provide valuable information concerning the daily and seasonal variation of the Loran-C signals for use in non-precision approach studies. With the aid of a second monitor, located in Gallion, Ohio, it can be determined if the errors found at a particular geographic location correlate with those found at another location. This will give some indication as to how far apart monitors can be positioned to obtain accurate non-precision approach data for various airports.
Author

N87-27601*# Ohio Univ., Athens.
DIGITAL AUTONOMOUS TERMINAL ACCESS COMMUNICATIONS **c32**
S. Novacki *In* NASA, Langley Research Center, Joint University Program for Air Transportation Research, 1985 Jul. 1987 p 43-46 (For primary document see N87-27596 22-01)
Avail: NTIS HC A05/MF A01 CSCL 17B

A significant problem for the Bus Monitor Unit is to identify the source of a given transmission. This problem arises from the fact that the label which identifies the source of the transmission as it is put into the bus is intercepted by the Digital Autonomous Terminal Access Communications (DATAC) terminal and removed from the transmission. Thus, a given subsystem will see only data associated with a label and never the identifying label itself. The Bus Monitor must identify the source of the transmission so as to be able to provide some type of error identification/location in the event that some problem with the data transmission occurs. Steps taken to alleviate this problem by modifications to the DATAC terminal are discussed. Author

N87-27602*# Ohio Univ., Athens.
INERTIAL/MULTISENSOR NAVIGATION **c04**
Dimitri Alikiotis *In* NASA, Langley Research Center, Joint University Program for Air Transportation Research, 1985 Jul. 1987 p 47-51 (For primary document see N87-27596 22-01)
Avail: NTIS HC A05/MF A01 CSCL 17G

A Multisensor Navigation System as proposed by the Ohio University Avionics Engineering Center is illustrated. The proposed system incorporates radio (Lorac-C), satellite (Global Positioning System) and an inertial navigation system (INS). The inertial part

of the system will be of a low grade since the INS will be used primarily for filtering the GPS data and for short term stability. Loran-C and GPS will be used for long term stability. Author

N87-27603*# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
INVESTIGATION OF AIR TRANSPORTATION TECHNOLOGY AT PRINCETON UNIVERSITY, 1985 **c03**
Robert F. Stengel *In* NASA, Langley Research Center, Joint University Program for Air Transportation Research, 1985 Jul. 1987 p 55-61 (For primary document see N87-27596 22-01)
Avail: NTIS HC A05/MF A01 CSCL 01C

The program proceeded along five avenues during 1985. Guidance and control strategies for penetration of microbursts and wind shear, application of artificial intelligence in flight control and air traffic control systems, the use of voice recognition in the cockpit, the effects of control saturation on closed-loop stability and response of open-loop unstable aircraft, and computer aided control system design are among the topics briefly considered. Areas of investigation relate to guidance and control of commercial transports as well as general aviation aircraft. Interaction between the flight crew and automatic systems is the subject of principal concern. Author

N87-27604*# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
OPTIMIZATION OF AIRCRAFT TRAJECTORIES THROUGH SEVERE MICROBURSTS **c05**
Mark L. Psiaki *In* NASA, Langley Research Center, Joint University Program for Air Transportation Research, 1985 Jul. 1987 p 63-72 (For primary document see N87-27596 22-01)
Avail: NTIS HC A05/MF A01 CSCL 01C

A method of defining performance envelopes for aircraft microburst penetration is being developed. A trajectory is computed for a given aircraft/control law configuration and given microburst parameters (either a downdraft or a head/tailwind type microburst). The maximum deviation from the nominal altitude is recorded for that trajectory. Then the microburst parameters are varied, and the process is repeated. Thus a three dimensional plot of maximum altitude deviation versus microburst range scale and intensity is generated. Finally, a certain maximum altitude deviation, say 50 feet, is defined as the safe penetration limit. Then the 50 foot level contour becomes the performance limit for safe operation as a function of microburst intensity and range. Control inputs from deterministic trajectory optimization are used in the above described calculations to define the maximal performance limit. These limits provide targets for the designer of practical control laws. Author

N87-27605*# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
FAULT-TOLERANT FLIGHT CONTROL SYSTEM COMBINING EXPERT SYSTEM AND ANALYTICAL REDUNDANCY CONCEPTS **c08**
Dave Handelman *In* NASA, Langley Research Center, Joint University Program for Air Transportation Research, 1985 Jul. 1987 p 73-85 (For primary document see N87-27596 22-01)
Avail: NTIS HC A05/MF A01 CSCL 01C

This research involves the development of a knowledge-based fault-tolerant flight control system. A software architecture is presented that integrates quantitative analytical redundancy techniques and heuristic expert system problem solving concepts for the purpose of in-flight, real-time failure accommodation. Author

N87-27606*# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
EFFECTS OF JOINT RATE AND DISPLACEMENT CONSTRAINTS ON STABILITY REGIONS **c08**
P. C. Shrivastava *In* NASA, Langley Research Center, Joint University Program for Air Transportation Research, 1985 Jul. 1987 p 87-97 (For primary document see N87-27596 22-01)
Avail: NTIS HC A05/MF A01 CSCL 01C

A block diagram showing plant dynamics in normal mode coordinates, a linear feedback controller with command limits, and actuator dynamics with rate and displacement limits is given. The objective is to examine the effects of joint rate and displacement saturation limits on the stability regions. An unstable short period dynamic model is transformed into normal mode coordinates and is augmented with actuator dynamics. A linear feedback controller is used to provide closed-loop stability. The stability with constrained actuator rate limits under varying bandwidth, displacement and command limits is examined. Author

N87-27607*# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
AN EXPERT SYSTEM FOR AIR TRAFFIC CONTROL SYSTEM **c04**
Takashi Sensui *In* NASA, Langley Research Center, Joint University Program for Air Transportation Research, 1985 Jul. 1987 p 99-103 (For primary document see N87-27596 22-01)
Avail: NTIS HC A05/MF A01 CSCL 17G

The objective was to design a control logic which automates all or part of the guidance function for air traffic control systems. Particular interest was focused on automation of the terminal area control system. A preliminary study was done on the development of an expert system. The system may be used to assist controllers by providing them with feasible options in guiding each aircraft in the control area to its desired destination. Author

N87-27608# RAND Corp., Santa Monica, Calif.
NATIONAL AEROSPACE PLANE PROGRAM: PRINCIPAL ASSUMPTIONS, FINDINGS, AND POLICY OPTIONS
Scott Pace Dec. 1986 24 p
(P-7288-RGS) Avail: NTIS HC A02/MF A01

Top-level issues raised by the National Aerospace Plane Program (NASP) are outlined. The principal points addressed were: major uncertainties in the rate of NASP technical progress, cost projections, and potential applications of NASP technology; NASP development costs and possible increases may force tradeoffs with other research and development efforts; the FY88-89 budget will require decisions on major funding increases for flying technology demonstrations; the high classification of some NASP technologies is limiting independent evaluation and may reduce commercial spinoff. B.G.

N87-27609*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SOME INNOVATIONS AND ACCOMPLISHMENTS OF AMES RESEARCH CENTER SINCE ITS INCEPTION
May 1987 38 p Original contains color illustrations
(NASA-TM-88348; A-86375; NAS 1.15:88348) Avail: NTIS HC A03/MF A01 CSCL 01B

The innovations and accomplishments of Ames Research Center from 1940 through 1966 are summarized and illustrated. It should be noted that a number of accomplishments were begun at the NASA Dryden Flight Research Facility before that facility became part of the Ames Research Center. Such accomplishments include the first supersonic flight, the first hypersonic flight, the lunar landing research vehicle, and the first digital fly-by-wire aircraft. Author

N87-27610# Michigan State Univ., East Lansing.
CORROSION MAINTENANCE AND EXPERIMENTAL DESIGN Final Report, 1 Apr. 1984 - 31 Mar. 1986
Robert Summitt 30 Jan. 1987 82 p
(Contract F33615-84-C-5066)
(AD-A181926; AFWAL-TR-86-4074) Avail: NTIS HC A05/MF A01 CSCL 11F

The objective of this program was to provide external assessments, analyses, experimental design, liaison, and direction in support of logistics-oriented technology research and development programs sponsored by AFWAL Materials Laboratory and the Air Force logistics Command. The purpose was to provide Air Force program management maximum visibility of the overall direction of efforts in: (1) evaluation of corrosion inhibitor

effectiveness for aircraft rinsing, (2) improvements to AFLC's Maintenance Data Collection System (MDCS), (3) improvements to base level corrosion severity indices, and (4) adapting corrosion prediction to an airworthiness model. GRA

N87-27611# Naval Postgraduate School, Monterey, Calif.
THE EFFECTS OF FLIGHT HOURS AND SORTIES ON FAILURE RATES M.S. Thesis
Steven J. Phillips Mar. 1987 139 p
(AD-A182084) Avail: NTIS HC A07/MF A01 CSCL 01B

This thesis focuses on the modeling of F-14A component failure rates. Current methodology employs the Exponential distribution to model component failures and the associated Poisson distribution to determine expected demand. Three other failure rate distributions are explored as alternatives: a Weibull flight hour model, a Geometric sortie-dependent model, and a Mixed sortie-flight hour model. The expected number of component failures is calculated for each model and a comparison is made between the current model and these alternatives. The specific results pertain to aircraft of this type but the concepts employed can be applied to other aircraft as well. The Geometric model provided a better fit for components which were not operated continuously, and the Weibull performed better when the components were operated continuously. Overall, the Exponential was the least effective model for the nine components studied. GRA

N87-27612# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHINA AERODYNAMICS RESEARCH SOCIETY
10 Apr. 1987 242 p Transl. into ENGLISH of Kongquidonglixue Xuebao (China), v. 4, no. 1, 1986 p 1-127
(AD-A182577; FTD-ID(RS)T-0853-86) Avail: NTIS HC A11/MF A01 CSCL 01A

Following are the partial contents of a report by the China Aerodynamics Researxh Society: Airfoil Design at Sonic Velocity; Passive Control of Shock Waves on Transonic Airfoils; Computer-Aided Asymptotic Expansions of Solution for Incompressible Potential Flow in Slender Two-Dimensional Nozzle; Numerical Modeling of Combustor Recirculation Flowfield; Multiple Laminar Flows of a Viscous, Incompressible Fluid Through a Curved Tube; An Improvement to the Numerical Method for Calculations of Aircraft Configuration Longitudinal Aerodynamic Characteristics; Numerical Calculation of Swirling Flow in Combustor; Calculation of Transonic Viscous Flows Over an Arbitrary Airfoil; A Review of Aerodynamic Characteristics for Several Recovery Schemes of Reentry Vehicles; A Primary Investigation of Drag Reduction and Mechanism for a Blunt Body of Revolution with Slanted Base. GRA

N87-27613* National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 217)
Sep. 1987 134 p
(NASA-SP-7037(217); NAS 1.21:7037(217)) Avail: NTIS HC A07 CSCL 01B

This bibliography lists 450 reports, articles, and other documents introduced into the NASA scientific and technical information system in August, 1987. Author

N87-27614# Federal Aviation Administration, Washington, D.C. Aircraft Manufacturing Div.
EXPORT AIRWORTHINESS APPROVAL PROCEDURES
7 Aug. 1987 194 p
(FAA-AC-21-2F) Avail: NTIS HC A09/MF A01

A method was devised for estimating ozone depletion for various assumptions regarding the future release of chlorocarbons (CLCs) into the atmosphere. The method is calibrated against published results obtained with more elaborate models of atmospheric chemistry. The method is applied to various scenarios for future CLC emissions, with and without emission controls. Estimates are also made of the climatic effects of CLC emissions, as represented by the average surface temperature of the Earth. It is concluded that current rates of emission present no immediate danger to the Earth and its inhabitants and would not do so for many decades. However, growth in CLC emissions at 3%/year or more, as seems likely, would eventually lead to unacceptable changes both in total ozone density and in surface temperature. Although no corrective action appears necessary at present, given the long times needed to develop and introduce substitutes or to implement effective emission controls, such actions may be necessary within the next one to three decades. M.G.

N87-27615* National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 216)
Aug. 1987 147 p
(NASA-SP-7037(216); NAS 1.21:7037(216) Avail: NTIS HC A07; NTIS standing order as PB86-914100. $7.00 domestic, $14.00 foreign CSCL 01B

This bibliography lists 505 reports, articles and other documents introduced into the NASA scientific and technical information system in July, 1987. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N87-27616*# Stanford Univ., Calif. Joint Inst. for Aeronautics and Acoustics.
CONTROL OF VORTICAL SEPARATION ON CONICAL BODIES
Nikos J. Mourtos and Leonard Roberts Jun. 1987 195 p
(Contract NCC2-326)
(NASA-CR-181206; NAS 1.26:181206; JIAA-TR-78) Avail: NTIS HC A09/MF A01 CSCL 01A

In a variety of aeronautical applications, the flow around conical bodies at incidence is of interest. Such applications include, but are not limited to, highly maneuverable aircraft with delta wings, the aerospace plane and nose portions of spike inlets. The theoretical model used has three parts. First, the single line vortex model is used within the framework of slender body theory, to compute the outer inviscid field for specified separation lines. Next, the three dimensional boundary layer is represented by a momentum equation for the cross flow, analogous to that for a plane boundary layer; a von Karman Pohlhausen approximation is applied to solve this equation. The cross flow separation for both laminar and turbulent layers is determined by matching the pressure at the upper and lower separation points. This iterative procedure yields a unique solution for the separation lines and consequently for the position of the vortices and the vortex lift on the body. Lastly, control of separation is achieved by blowing tangentially from a slot located along a cone generator. It is found that for very small blowing coefficients, the separation can be postponed or suppressedy completely. Author

N87-27617*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ON BLOCKAGE CORRECTIONS FOR TWO-DIMENSIONAL WIND TUNNEL TESTS USING THE WALL-PRESSURE SIGNATURE METHOD
S. R. Allmaras (Massachusetts Inst. of Tech., Cambridge.) Mar. 1986 26 p
(NASA-TM-86759; A-86267; NAS 1.15:86759) Avail: NTIS HC A03/MF A01 CSCL 01A

The Wall-Pressure Signature Method for correcting low-speed wind tunnel data to free-air conditions has been revised and improved for two-dimensional tests of bluff bodies. The method uses experimentally measured tunnel wall pressures to approximately reconstruct the flow field about the body with

potential sources and sinks. With the use of these sources and sinks, the measured drag and tunnel dynamic pressure are corrected for blockage effects. Good agreement is obtained with simpler methods for cases in which the blockage corrections were about 10% of the nominal drag values. Author

N87-27618# European Space Agency, Paris (France).
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE SHOCK REFLECTION IN THREE DIMENSIONAL, STEADY, CONICAL SUPERSONIC FLOWS
Reinhard Niehuis Jan. 1987 126 p Transl. into ENGLISH of Theoretische und Experimentelle Untersuchungen zur Stossreflexion in Dreidimensionalen, Stationaeren, Kegeligen Ueberschallstroemungen (Goettingen, West Germany, DFVLR), Dec. 1985 Original language document was announced as N86-32412
(ESA-TT-1000; DFVLR-FB-86-07; ETN-87-90007) Avail: NTIS HC A07/MF A01; original German version available from DFVLR, Cologne, West Germany DM 34

Transition from regular to Mach reflection of shock waves for a three-dimensional, steady, conical, supersonic flow is investigated. For corner flows it is shown that transition is described by the von Neumann criterion as in two-dimensional steady flows, if the shock waves are sufficiently strong. Only Mach reflections were observed in corner flows. Applying the criterion, corner configurations in which the conditions for the occurrence of regular shock reflections are fulfilled were found. Experiments verify this but indicate that the shock reflection is influenced by the downstream boundary condition, if it is not sufficiently free. The shock wave structure in the corner was determined by optical and tomographical techniques allowing nonintrusive measurements. ESA

N87-27619# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction Scientifique de la Resistance des Structures.
DEVELOPMENT OF A COMPUTING CODE FOR THREE DIMENSIONAL UNSTEADY TRANSONIC SMALL PERTURBATIONS Final Report [DEVELOPPEMENT DU CODE DE CALCUL DES PARTIES PERTURBATIONS TRANSSONIQUES INSTATIONNAIRES EN TRI-DIMENSIONNEL]
P. Mulak Dec. 1986 24 p In FRENCH
(Contract STPA-85-95-004)
(ONERA-RT-27/3064-RY-052-R; ETN-87-90126) Avail: NTIS HC A02/MF A01

A direct fluid-structure coupling computing method is presented as an evolution of an existing two dimensional method based on the ONERA flow computation program to analyze aeronautical profiles. The aeroelasticity computations give the frequency-damping of the profile, diminishing the overall computation time. It is argued that with the traditional indirect method, only the first harmonics are used to compute the overall lift, while the presented method eliminates the negative aspects of that approximation. ESA

N87-27620*# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.
A DIRECT-INVERSE METHOD FOR TRANSONIC AND SEPARATED FLOWS ABOUT AIRFOILS Final Report
Leland A. Carlson May 1986 81 p
(Grant NsG-1174)
(NASA-CR-181233; NAS 1.26:181233) Avail: NTIS HC A05/MF A01 CSCL 01A

A direct-inverse technique called TAMSEP that can be used for the analysis of the flow about airfoils at subsonic and low transonic freestream velocities is presented. The method is based upon the direct-inverse nonconservative full potential inviscid method, a Thwaites laminar boundary layer technique, and the Barnwell turbulent momentum integral scheme. It is formulated using Cartesian coordinates. The method is suitable for predicting the flowfield about airfoils having trailing edge separated flow under high lift conditions. Comparisons with experimental data indicate that the method should be a useful tool for applied aerodynamic analysis. Author

N87-27621*# Joint Inst. for Advancement of Flight Sciences, Hampton, Va.
SOLUTION OF SEPARATED FLOWS USING A SIMULTANEOUS ITERATION TECHNIQUE Final Report
21 Feb. 1986 20 p
(Grant NAG1-573)
(NASA-CR-181262; NAS 1.26:181262) Avail: NTIS HC A02/MF A01 CSCL 01A

Generalization and improvement of an earlier work developed for studying separated flows using boundary layer type equations are presented. The improvements include extensions to a general coordinate system and use of a more general zonal technique for solving the coupled equations. In order to be able to consider arbitrary geometries, second order accurate (in space) conservative differences are generated by considering the integral formulation of the governing equations in a general coordinate system. The general coordinate system is handled in as general a manner as possible to allow for the use of either analytically or numerically generated coordinate systems. A marching procedure was used for solving the Partially Parabolized Navier-Stokes (PPNS) equations in the viscous region coupled in a fully implicit manner with the elliptic inviscid equation. To test the algorithm and compare to other solutions, solutions for flow over a flat plate and flow past the symmetrical 12 percent thick Joukowski airfoil (J012) at zero angle of attack were presented. B.G.

N87-27622*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CALCULATION OF VISCOUS EFFECTS ON TRANSONIC FLOW FOR OSCILLATING AIRFOILS AND COMPARISONS WITH EXPERIMENT
James T. Howlett and Samuel R. Bland Sep. 1987 77 p
(NASA-TP-2731; L-16289; NAS 1.60:2731) Avail: NTIS HC A05/MF A01 CSCL 01A

A method is described for calculating unsteady transonic flow with viscous interaction by coupling a steady integral boundary-layer code with an unsteady, transonic, inviscid small-disturbance computer code in a quasi-steady fashion. Explicit coupling of the equations together with viscous -inviscid iterations at each time step yield converged solutions with computer times about double those required to obtain inviscid solutions. The accuracy and range of applicability of the method are investigated by applying it to four AGARD standard airfoils. The first-harmonic components of both the unsteady pressure distributions and the lift and moment coefficients have been calculated. Comparisons with inviscid calcualtions and experimental data are presented. The results demonstrate that accurate solutions for transonic flows with viscous effects can be obtained for flows involving moderate-strength shock waves. Author

N87-27623*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
UNSTEADY HYBRID VORTEX TECHNIQUE FOR TRANSONIC VORTEX FLOWS AND FLUTTER APPLICATION Progress Report, 1 Jan. - 31 Jul. 1987
Osama A. Kandil Aug. 1987 49 p
(Grant NAG1-648)
(NASA-CR-180308; NAS 1.26:180308) Avail: NTIS HC A03/MF A01 CSCL 01A

Papers resulting from work performed from January 1, 1987 to July 31, 1987 are listed. Transonic computational schemes based on Integral Equation Formulation of the full potential equation were presented. Classical and zero-total pressure-loss sets of Euler equations applied to delta wings were examined. For individual titles, see N87-27624 through N87-27625.

N87-27624*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.

TRANSONIC AIRFOIL COMPUTATION USING THE INTEGRAL EQUATION WITH AND WITHOUT EMBEDDED EULER DOMAINS

Osama A. Kandil and Hong Hu *In its* Unsteady Hybrid Vortex Technique for Transonic Vortex Flows and Flutter Applications Aug. 1987 15 p Presented at the 9th International Conference on Boundary Element Methods in Engineering, Stuttgart, West Germany, 31 Aug. - 4 Sep. 1987 (For primary document see N87-27623 22-02)

Avail: NTIS HC A03/MF A01 CSCL 01A

Two transonic computational schemes which are based on the Integral Equation Formulation of the full potential equation were presented. The first scheme is a Shock Capturing-Shock Fitting (SCSF) scheme which uses the full potential equation throughout with the exception of the shock wave where the Rankine-Hugoniot relations are used to cross and fit the shock. The second scheme is an Integral Equation with Embedded Euler (IEEE) scheme which uses the full potential equation with an embedded region where the Euler equations are used. The two schemes are applied to several transonic airfoil flows and the results were compared with numerous computational results and experimental domains with fine grids. The SCSF-scheme is restricted to flows with weak shock, while the IEEE-scheme can handle strong shocks. Currently, the IEEE scheme is applied to other transonic flows with strong shocks as well as to unsteady pitching oscillations. Author

N87-27625*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.

APPLICATIONS OF CLASSICAL AND ZERO-TOTAL-PRESSURE-LOSS SETS OF EULER EQUATIONS TO DELTA WINGS

Osama A. Kandil and Andrew H. Chuang *In its* Unsteady Hybrid Vortex Technique for Transonic Vortex Flows and Flutter Applications Aug. 1987 29 p Presented at the 1st International Conference on Industrial and Applied Mathematics, Le Chesnay, France, 29 Jun. - 3 Jul. 1987 (For primary document see N87-27623 22-02)

Avail: NTIS HC A03/MF A01 CSCL 01A

Classical and zero-total pressure-loss sets of Euler equations were applied to sharp- and round-edge delta wings. The origin of the total pressure was explained in the classical set. For sharp-edged delta wings, all sets of Euler equations produce the same separated flow solutions. For round-edged delta wings and for coarse grids, the solution depends on the level of dissipation, the accuracy of the surface boundary condition, and the type of Euler equations set. For round-edged delta wings and for fine grids, attached flow solutions are obtained. Also presented were three dimensional flow solutions and asymmetric flow solutions including unsteady flow for sharp-edged delta wings. Euler equations should be restricted to sharp-edged wings for real flow solutions. For roung-edged wings, Navier-Stokes equations must be used. B.G.

N87-27626*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

DRAG MEASUREMENTS OF BLUNT STORES TANGENTIALLY MOUNTED ON A FLAT PLATE AT SUPERSONIC SPEEDS

Floyd J. Wilcox, Jr. Sep. 1987 68 p

(NASA-TP-2742; L-16284; NAS 1.60:2742) Avail: NTIS HC A04/MF A01 CSCL 01A

An investigation has been conducted in the Langley Unitary Plan Wind Tunnel to measure the drag of blunt stores (hemispherical noses and afterbodies) tangentially mounted in various arrays on a flat plate at nominal Mach numbers of 1.60, 1.90, 2.16,and 2.86 and at a nominal Reynolds number of 2X10 to the 6th power per foot. The arrays consisted of two and three stores mounted in lateral, tandem, or staggered arrangements. The relative position of the stores in the arrays was varied while the drag of only one store was measured to determine the effect of spacing on the store drag. Store-on-store interference was determined by comparing the drag of a single store with the drag of the store in an array. The results indicate virtually all arrangements and spacings which were tested had favorable store-on-store interference (drag reduction) across the Mach number range. Tabulated data, schlieren photographs, and shadowgraphs are included. Author

N87-27627*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SUPERSONIC AERODYNAMIC CHARACTERISTICS OF A SPACE SHUTTER ORBITER MODEL AT ANGLES OF ATTACK FROM 20 DEG TO 90 DEG

Bernard Spencer, Jr. and Robert L. Calloway Jul. 1987 46 p (NASA-TM-89112; NAS 1.15:89112) Avail: NTIS HC A03/MF A01 CSCL 01A

Space Shuttle Orbiter aerodynamic characteristics have been determined in the angle-of-attack range from 20 to 90 degrees and Mach numbers from 4.60 to 1.80 at Reynolds numbers, based on body length, of 2.15 x 10 to the 6th and 4.30 x 10 to the 6th power. Emphasis is on vehicle stability, control, and trim characteristics above a 60 degree angle of attack. The model used was a 0.986 percent scale Orbiter, having a blade-mounted support system entering the model in the region of the vertical tail. Elevon deflections of 0, -10, -20, and -40 degrees and body-flap deflections of 0, +6 and -12 degrees were investigated individually and in combination. Schlieren photographs are also presented for selected configurations and Mach numbers. The Orbiter was found to be longitudinally stable and trimmable in the angle-of-attack range from approximately 60 to 80 degrees. Both the elevon and body flap provided positive pitch control-effectiveness at angles of attack from 60 to 80 degrees and the Mach numbers of this study. For the range of neutral to stable trim in the angle-of-attack range above about 55 degrees, the deflected elevon/body-flap combination provided positive trimmed lift and lift/drag ratios. Author

N87-27628*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF VARIABLE INLET GUIDE VANES ON THE OPERATING CHARACTERISTICS OF A TILT NACELLE INLET/POWERED FAN MODEL

R. R. Woollett and H. C. Pontonides (Grumman Aerospace Corp., Bethpage, N.Y.) Sep. 1987 41 p

(NASA-TM-88983; E-3453; NAS 1.15:88983) Avail: NTIS HC A03/MF A01 CSCL 01A

The effects of a variable inlet guide vane (VIGV) assembly on the operating characteristics of a V/STOL inlet and on the performance of a 20-in. (0.508-m) diameter fan engine were investigated. The data indicate that the VIGVs are effective thrust modulators over a wide range of free-stream velocities, nacelle angles of attack, and fan speeds. The thrust modulation ranges, including choking limits, fan stall limits, and inlet separation boundaries are presented. The presence of the VIGV assembly causes significant losses in inlet angle-of-attack capability and generally increases the blade stress levels at all limit conditions except at high angle of attack and high free-stream velocity. Reducing the fan nozzle exit area limited the positive VIGV actuation range and consequently decreased the range of thrust modulation at all limit conditions except at both high free-stream velocity and high angle of attack conditions. Author

N87-27629*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INITIAL TURBULENCE EFFECT ON JET EVOLUTION WITH AND WITHOUT TONAL EXCITATION

G. Raman, K. B. M. Q. Zaman, and E. J. Rice [1987] 17 p Prepared for presentation at the 11th Aeroacoustics Conference, Sunnyvale, Calif., 19-21 Oct. 1987; sponsored by AIAA

(NASA-TM-100178; E-3702; NAS 1.15:100178; AIAA-87-2725) Avail: NTIS HC A02/MF A01 CSCL 01A

The effect of initial turbulence level on the development of a jet and on the susceptability of the jet to discrete tone excitation was experimentally investigated. Turbulence intensity was varied, over the range 0.15 to 5 percent, by using screens and grids

placed upstream of an 8.8 cm diameter nozzle. Top-hat mean velocity profiles with approximately identical initial boundary layer states were ensured in all cases; the turbulence spectra were broadband. It was found, contrary to earlier reports, that the natural jet decay remained essentially unchanged for varying initial turbulence. For a fixed amplitude of the tonal excitation, increasing the initial turbulence damped out the growth of the instability wave; as a result, the excitability, assessed from the mean velocity decay on the axis, was found to diminish. However, the degree of damping in the amplification of the instability wave was only slight compared to the large increase in the initial turbulence. The jet with 5 percent turbulence could be measurably altered by excitation with a velocity perturbation amplitude as little as 0.25 percent of the jet velocity. The amplitude effect data indicate an upper bound of the extent to which a jet could be excited, and thus its plume shortened, by the plane wave, single frequency excitation. An additional data set with no grid or trip, yielding a nominally laminar boundary layer, re-emphasizes the profound effect of initial boundary layer state on jet evolution as well as on its excitability. This jet decayed the fastest naturally, and consequently, it was the least excitable in spite of its turbulence being the least. Author

N87-27630# Lawrence Livermore National Lab., Calif.
ADAPTIVE METHODS FOR HIGH MACH NUMBER REACTING FLOW
J. B. Bell, P. Colella, J. A. Trangenstein, and M. Welcome Apr. 1987 29 p Presented at the 8th American Institute of Aeronautics and Astronautics Computational Fluid Dynamics Conference, Honolulu, Hawaii, 9 Jun. 1987
(Contract W-7405-eng-48)
(DE87-008846; UCRL-96443; CONF-8706104-2) Avail: NTIS HC A03/MF A01

This paper describes some adaptive techniques suitable for modeling high Mach number reacting flows. Two basic types of methods are considered: adaptive mesh techniques and front tracking. Numerical results are described using one of these methods, local mesh refinement, for a simple model for planar detonation. The computational results show the formation of Mach triple points in the detonation fronts and provide an initial step toward understanding the factors influencing the spacing. DOE

N87-27631*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MODELING XV-15 TILT-ROTOR AIRCRAFT DYNAMICS BY FREQUENCY AND TIME-DOMAIN IDENTIFICATION TECHNIQUES
Mark B. Tischler and Juergen Kaletka (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick, West Germany) Dec. 1986 23 p Prepared in cooperation with Army Aviation Research and Development Command, Moffett Field, Calif.
(NASA-TM-89404; A-86435; NAS 1.15:89404; USAAVSCOM-TR-86-A-3) Avail: NTIS HC A02/MF A01 CSCL 01A

Models of the open-loop hover dynamics of the XV-15 Tilt-Rotor Aircraft are extracted from flight data using two approaches: frequency-domain and time-domain identification. Both approaches are reviewed and the identification results are presented and compared in detail. The extracted models compare favorable, with the differences associated mostly with the inherent weighting of each technique. Step responses are used to show that the predictive capability of the models from both techniques is excellent. Based on the results of this study, the relative strengths and weaknesses of the frequency- and time-domain techniques are summarized, and a proposal for a coordinated parameter identification approach is presented. Author

N87-27632# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
REDUCTION OF WALL INTERFERENCE FOR 3-DIMENSIONAL MODELS WITH 2-DIMENSIONAL WALL ADAPTATION Ph.D. Thesis - Univ. Libre de Bruzelles
Louis Lamarche Dec. 1986 248 p
Avail: NTIS HC A11/MF A01

Louis Lamarche Dec. 1986 248 p
Avail: NTIS HC A11/MF A01

The applicability of two dimensional wall adaptation (upper and lower walls) for three dimensional flows was studied. Two different algorithms were developed depending on the validity of the linearity assumption near the walls. Numerical simulations as well as experimental tests were done to corroborate the method. Author

N87-27633# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Dept. de Engenharia Mecanica Espacial.
COMPARING AN IMPROVED FIRST ORDER PANEL METHOD RESULTS WITH WIND-TUNNEL MEASUREMENTS FOR A COMPLETE AIRPLANE CONFIGURATION
Francisco Leme Galvao Feb. 1987 14 p Presented at the Boundary Element Technology Congress, BETECH-Rio/87, Brazil, 2-4 Jun. 1987
(INPE-4132-PRE/1043) Avail: NTIS HC A02/MF A01

A numerical computation of pressure distribution over a complete commercial airplane configuration, using an improved first order panel method, is made and results are compared with experimental measurements obtained for the same configuration with a 1/14 model in a wind tunnel. Author

N87-27634# Naval Postgraduate School, Monterey, Calif.
VISCOUS/INVISCID INTERACTION ANALYSIS OF THE AERODYNAMIC PERFORMANCE OF THE NACA 65-213 AIRFOIL M.S. Thesis
Phutut H. Subroto Mar. 1987 112 p
(AD-A182091) Avail: NTIS HC A06/MF A01 CSCL 20D

Cebeci's viscous/inviscid interaction program was applied to the analysis of steady two-dimensional incompressible flow past a NACA 65-213 airfoil at zero angle of attack at a Reynolds number of 240,000. Predicted boundary layer characteristics were found to be quite sensitive to the choice of boundary layer transition begin and length. Good agreement with the experimental results of Hoheisel et al could be obtained by proper choice of both transition begin and length. GRA

N87-27635# McDonnell-Douglas Corp., Long Beach, Calif.
SEPARATION AND REATTACHMENT NEAR THE LEADING EDGE OF A THIN OSCILLATING AIRFOIL Final Report, 15 Mar. 1985 - 14 Oct. 1986
Tuncer Cebeci, A. A. Khattab, and S. M. Schimke Dec. 1986 44 p
(Contract F49620-85-C-0063)
(AD-A182231; MDC-J4847; AFOSR-87-0618TR) Avail: NTIS HC A03/MF A01 CSCL 20D

The evolution of unsteady boundary layers in the vicinity of the leading edge of a thin oscillating airfoil has been examined with a novel numerical method which is able to deal with the movement of the stagnation point and with regions of reverse and separated flow. Solutions to the unsteady boundary-layer equations, with a prescribed pressure distribution which causes flow reversal and separation, demonstrate the importance of numerical steps in distance and time, and that a requirement similar to the stability criterion of Courant, Friedrichs and Lewy must be satisfied to avoid numerical errors. At the lower reduced frequencies of the investigations, solutions could not be obtained with this procedure and it was necessary to introduce interaction between the viscous and inviscid flows. The solutions obtained with the interactive method were increasingly different from those without interaction as the reduced frequency was decreased towards zero and, for some combinations of Reynolds number and frequency, exhibited behavior consistent with the instability of separation bubbles. GRA

N87-27636# Ballistic Research Labs., Aberdeen Proving Ground, Md.
IMPROVED NUMERICAL PREDICTION OF TRANSONIC FLOW
Jubaraj Sahu and Charles J. Nietubicz Mar. 1987 34 p
(AD-A182250; AD-E951026; BRL-TR-2784) Avail: NTIS HC A03/MF A01 CSCL 20D

The time dependent Navier Stokes computational technique has been in general use to predict transonic flows over projectiles. Recently, efforts have been made to improve the computational efficiency of this code by analyzing and including a spatially varying time step and various improved artificial dissipation models. The combined effect of these changes has led to a significant gain in the robustness and convergence characteristics for steady state applications. These techniques have been used to compute the practical problem of flow over a projectile at a transonic speed. The results confirm the improvements achieved for such calculations. GRA

N87-27637*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NUMERICAL SIMULATIONS OF UNSTEADY AIRFOIL - VORTEX INTERACTIONS
G. R. Srinivasan and W. J. McCroskey 1987 23 p
(NASA-TM-89633; NAS 1.15:89633; AD-A182326) Avail: NTIS HC A02/MF A01 CSCL 20D

Unsteady interactions of a moving vortex with a stationary airfoil have been calculated using three different numerical methods based on the thin layer Navier-Stokes, Euler and transonic small-disturbance (TSD) equations. All three methods use a perturbation-form of an implicit numerical algorithm. Results are presented for both subsonic and transonic flow conditions and for weak and strong interactions. Results from these methods and from the other available numerical methods show qualitatively similar behavior for weak interactions. However, the stronger interactions considered proved to be beyond the capabilities of the transonic small-disturbance codes. In general, the results show a tremendous influence of the vortex on the flow field around the airfoil. The most dramatic results of the interaction seem to occur when the convecting vortex is within one chord of the airfoil. Even the weak interactions produced vortex/shock induced boundary-layer separation. GRA

N87-27638# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EXPERIMENTAL STUDY OF WING-IN-GROUND EFFECTS IN THE AFIT 5-FOOT WIND TUNNEL M.S. Thesis
Lawyn C. Edwards Mar. 1987 200 p
(AD-A182570; AFIT/GAE/AA/87M-1) Avail: NTIS HC A09/MF A01 CSCL 01A

The effect of flying close to the Earth's surface on the lift to drag ratio (L/D) was investigated. This was accomplished with the model of a NACA 4415 wing. The model was equipped with a full span adjustable flap and three sets of end and center plates. Ground boards were placed in the tunnel to simulate the Earth's surface. Five different heights of the model above the ground boards were selected to represent in and out of ground effect regimes. Data were collected for forces and pressures on the model and on the board. The graphical representation of results displayed the effects of changing model parameters versus force, moment and pressure coefficients. These conclusions were compared to theory and other literature for correlation. Results were conclusive. The effects of center plates and the variation of plate size were negligible. The presence of the set of end plates was beneficial near the surface but was negligible out of ground effects. The height of the model above the board produced noticeable differences in results. Angle of attack was shown to have a marked influence along with flap angle. Pressure plots also appeared to provide a method of predicting the amount of lift produced. GRA

N87-27639# Ballistic Research Labs., Aberdeen Proving Ground, Md.
AUTOMATIC PLOTTING ROUTINES FOR ESTIMATING STATIC AERODYNAMIC PROPERTIES OF FLARED PROJECTILES FOR 2 LESS THAN M LESS THAN 5 Final Report
William F. Donovan Mar. 1987 41 p
(AD-A182615; BRL-MR-3573) Avail: NTIS HC A03/MF A01 CSCL 01A

This report is intended to be used in the formulation of quick estimates of the static aerodynamic characteristics of the conventional flared projectile. The data is based primarily on E. D. Boyer, Free Flight Range Tests of a Minuteman Re-entry Stage Model, and AMCP 706-280, Design of Aerodynamically Stabilized Free Rockets, and the exposition follows that of the corresponding finned projectile presentation. The drag, static moment and normal force coefficients are determined from the simplified geometry of the projectile and the bounding aerodynamic conditions, i.e., sea level, flat fire, 2 less than M less than 5, and small yaw. The computer program is written in the Hewlett-Packard Basic Language and is easily transferred to other BASIC-language microcomputers. GRA

N87-27640# Air Force Armament Lab., Eglin AFB, Fla.
AN ANALYSIS OF THE VISCOUS BURGERS EQUATION AS MODELED BY THE MACCORMACK METHOD Final Report, Oct. 1985 - Dec. 1986
Jon S. Mounts, Dave M. Belk, and Montgomery C. Hughson Jun. 1987 92 p
(AD-A182763; AD-E801526; AFATL-TR-87-12) Avail: NTIS HC A05/MF A01 CSCL 20D

This report serves as an instructional aid in the analysis of the numerical techniques used in current computational fluid dynamic (CFD) Flow Solvers. A second-order, explicit predictor-corrector method, developed by MacCormack, is analyzed for stability, convergence, conservative property error, transportive property error, dispersion and phase error, and dissipation error, with respect to the viscous Burgers equation. The viscous Burgers equation is used as a nonlinear analog to the three-dimensional equations typically used in CFD analyses. GRA

N87-27641*# Rockwell International Corp., Columbus, Ohio.
LOW SPEED WIND TUNNEL TEST OF A PROPULSIVE WING/CANARD CONCEPT IN THE STOL CONFIGURATION. VOLUME 1: TEST DESCRIPTION AND DISCUSSION OF RESULTS
V. R. Stewart Sep. 1987 96 p
(Contract NAS1-17171)
(NASA-CR-178348; NAS 1.26:178348) Avail: NTIS HC A05/MF A01 CSCL 01A

A propulsive wing/canard model was tested at STOL operating conditions in the NASA Langley Research Center 4 x 7 meter wind tunnel. Longitudinal and lateral/directional aerodynamic characteristics were measured for various flap deflections, angles of attack and sideslip, and blowing coefficients. Testing was conducted for several model heights to determine ground proximity effects on the aerodynamic characteristics. Flow field surveys of local flow angles and velocities were performed behind both the canard and the wing. This is volume 1 of a 2 volume report. The model, instrumentation, and test procedures are described. An analysis of the data is included. Author

N87-27642*# Rockwell International Corp., Columbus, Ohio.
LOW SPEED WIND TUNNEL TEST OF A PROPULSIVE WING/CANARD CONCEPT IN THE STOL CONFIGURATION. VOLUME 2: TEST DATA
V. R. Stewart Sep. 1987 405 p
(Contract NAS1-17171)
(NASA-CR-178349; NAS 1.26:178349) Avail: NTIS HC A18/MF A01 CSCL 01A

A propulsive wind/canard model was tested at STOL operating conditions in the NASA Langley Research Center 4 x 7 meter wind tunnel. Longitudinal and lateral/directional aerodynamic characteristics were measured for various flap deflections, angles of attack and sideslip, and blowing coefficients. Testing was conducted for several model heights to determine ground proximity effects on the aerodynamic characteristics. Flow field surveys of local flow angles and velocities were performed behind both the canard and the wing. This is volume 2 of a 2 volume report. All of the test data in three appendices are presented. Appendix A presented tabulated six component force and moment data,

Appendix B presents tabulated wing pressure coefficients, and Appendix C presents the flow field data. Author

N87-27643*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PRESSURE MEASUREMENTS ON A THICK CAMBERED AND TWISTED 58 DEG DELTA WING AT HIGH SUBSONIC SPEEDS
Julio Chu and John E. Lamar Sep. 1987 233 p
(NASA-TP-2713; L-16224; NAS 1.60:2713) Avail: NTIS HC A11/MF A01 CSCL 01A

A pressure experiment at high subsonic speeds was conducted by a cambered and twisted thick delta wing at the design condition (Mach number 0.80), as well as at nearby Mach numbers (0.75 and 0.83) and over an angle-of-attack range. Effects of twin vertical tails on the wing pressure measurements were also assessed. Comparisons of detailed theoretical and experimental surface pressures and sectional characteristics for the wing alone are presented. The theoretical codes employed are FLO-57, FLO-28, PAN AIR, and the Vortex Lattice Method-Suction Analogy. Author

N87-27644*# National Aeronautics and Space Administration, Washington, D.C.
STUDY OF A VARIABLE SWEEP WING IN SUB OR TRANSONIC FLOW
F. Manie, C. Rehbach, and V. Schmitt Sep. 1987 28 p Transl. into ENGLISH of conference paper Etude d'une Aile a Fleche Variable en Ecoulement sub ou Transonique presented at the 11th International Council of the Aeronautical Sciences Congress, 1978 Congress held in Lisbon, Portugal, 10-16 Sep. 1978 Original language document was announced in IAA as A81-14391 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TT-20117; NAS 1.77:20117) Avail: NTIS HC A03/MF A01 CSCL 01A

Experiments were performed on models of a variable sweep wing emphasizing in particular flow separation and appearance of vortex structures at low speeds and the formation of shock waves at transonic speeds. The results of these tests have been compared with those of calculations made by available procedures such as a panel method for unseparated flows and an unsteady method based on a volume discretization of the vortex vector for separated flows. Transonic flows were calculated using relaxation methods based on the perturbation theory and on the full potential equation. Author

N87-27645*# New Hampshire Univ., Durham. Dept. of Mechanical Engineering.
A NUMERICAL STUDY OF TRANSITION CONTROL BY PERIODIC SUCTION-BLOWING
Sedat Biringen Washington NASA Sep. 1987 24 p
(Grant NAG1-462)
(NASA-CR-4095; NAS 1.26:4095) Avail: NTIS HC A02/MF A01 CSCL 01A

The applicability of active control of transition by periodic suction-blowing is investigated via direct numerical simulations of the Navier-Stokes equations. The time-evolution of finite-amplitude disturbances in plane channel flow is compared in detail with and without control. The analysis indicates that, for relatively small three dimensional amplitudes, a two dimensional control effectively reduces disturbance growth rates even for linearly unstable Reynolds numbers. After the flow goes through secondary instability, three dimensional control seems necessary to stabilize the flow. An investigation of the temperature field suggests that passive temperature contamination is operative to reflect the flow dynamics during transition. Author

N87-27646*# Colorado Univ., Boulder. Dept. of Aerospace Engineering Sciences.
HYPERSONIC FLOW ANALYSIS Final Report, 1 Sep. 1986 - 31 Aug. 1987
Chuen-Yen Chow and James S. Ryan 31 Aug. 1987 8 p
(Contract NCC2-440)
(NASA-CR-181332; NAS 1.26:181332) Avail: NTIS HC A02/MF A01 CSCL 01A

While the zonal grid system of Transonic Navier-Stokes (TNS) provides excellent modeling of complex geometries, improved shock capturing, and a higher Mach number range will be required if flows about hypersonic aircraft are to be modeled accurately. A computational fluid dynamics (CFD) code, the Compressible Navier-Stokes (CNS), is under development to combine the required high Mach number capability with the existing TNS geometry capability. One of several candidate flow solvers for inclusion in the CNS is that of F3D. This upwinding flow solver promises improved shock capturing, and more accurate hypersonic solutions overall, compared to the solver currently used in TNS. Author

N87-27647 Alabama Univ., Huntsville.
NUMERICAL SIMULATION OF MULTIPLE JET INTERACTION Ph.D. Thesis
Sang Don Bai 1986 185 p
Avail: Univ. Microfilms Order No. DA8707944

A numerical simulation of a combustor with an annular injector plate and the interaction of three plane jets is performed with the objectives of studying the effects of the various kappa-epsilon turbulence models and inlet boundary conditions. The motivation was to understand the physics of the flow field inside the preburner of the Space Shuttle Main Engines (SSME) using a simplified geometry and numerical simulation. The computer code used in this multiple jet study is developed from the modified TEACH code, which is a steady state, isothermal fluid code that uses the SIMPLE algorithm. The physical validity and numerical accuracy of the simulation model is established through comparisons with experimental data. The effects of the coefficients of the turbulence model and inlet boundary conditions were examined. Simulated mean velocities and turbulent kinetic energy distributions are compared with the results from the flow experiment of Ghosh. The developed simulation model was applied to three jets and a baffle. A case of a single jet and a baffle was also calculated for qualitative comparisons with the multiple jet case. Interactions among multiple jets were also investigated. Dissert. Abstr.

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N87-27648# Federal Aviation Administration, Anchorage, Alaska.
JAL (JAPAN AIR LINES) FLIGHT 1628 UNIDENTIFIED TRAFFIC SIGHTING, NOVEMBER 17, 1986 Final Report
5 Mar. 1987 377 p
(PB87-184206; DOT/FAA/AL-87/1) Avail: NTIS HC A17/MF A01 CSCL 01C

On November 17, 1986, Japan Airlines Flight 1628, an all cargo Boeing 747, was enroute from Keflavik, Iceland, to Anchorage, Alaska. At 0219 UTC (November 18, 1986) the captain of Flight 1628 reported traffic at his altitude 1 mile in front of his aircraft. The unidentified traffic was later reported visible on JAL 1628's weather radar and intermittently by Anchorage Center and the Military Regional Operations Center. JAL 1628 reported that the traffic stayed in his vicinity during a descent and turns, including a 360 degree turn. At 0253 UTC, JAL 1628 reported that the unidentified traffic was no longer in sight. The report includes the inspection/investigator (Flight Standards) package, the Air Traffic package, radar data, and news release statements. GRA

N87-27649# National Transportation Safety Board, Washington, D. C. Bureau of Accident Investigation.
AIRCRAFT ACCIDENT REPORT: PIPER PA-23-150, N2185P AND PAN AMERICAN WORLD AIRWAYS BOEING 727-235, N4743, TAMPA, FLORIDA, NOVEMBER 6, 1986

25 Jun. 1987 56 p
(PB87-910407; NTSB/AAR-87/06) Avail: NTIS HC A04/MF A01 CSCL 01C

On November 6, 1986, a Piper PA-23 Apache, N2185P, was cleared for an instrument landing system approach to runway 36L at Tampa International Airport, Florida. The pilot was unable to land during his first approach. On the second approach, the Apache touched down on taxiway W, parallel to and about 406 feet to the right (east) of runway 36L. At the same time, a Pan American Boeing B-727 was proceeding southbound on taxiway W. When the captain of the B-727 saw the Apache emerge from the fog directly ahead of him, he turned to the right in an attempt to avoid the impending collision. About 2 seconds later, the Apache's left engine struck the B-727 in the radome. Two passengers and a flight attendant were injured after they evacuated the airplane. The Apache was almost destroyed and the pilot, the sole occupant of the airplane, was killed. The safety issues discussed in this report include the pilot's decision to continue his approach below decision height when the visibility was below landing minimums and the adequacy of current Federal regulations that allow pilots operating under Part 91 to conduct approaches when the reported visibility is below the published minimum visibility for landing. Author

N87-27650# National Transportation Safety Board, Washington, D. C. Bureau of Accident Investigation.
AIRCRAFT ACCIDENT/INCIDENT SUMMARY REPORT, KEFLAVIK, ICELAND, JANUARY 29, 1986
1 May 1987 10 p
(PB87-910406; NTSB/AAR-87/01/SUM) Avail: NTIS HC A02/MF A01; also available on subscription, North American Continent HC $60.00/year, all others write for quote CSCL 01C

A summary of an aircraft accident investigated by the National Transportation Safety Board is given. The accident occurred in International Waters, 36 miles west of Keflavik, Iceland, on January 29, 1986. GRA

N87-27651*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
UNIQUE RESEARCH CHALLENGES FOR HIGH-SPEED CIVIL TRANSPORTS
Charlie M. Jackson, Jr. and Charles E. K. Morris, Jr. Aug. 1987 19 p
(NASA-TM-100490; NAS 1.15:100490) Avail: NTIS HC A02/MF A01 CSCL 01C

Market growth and technological advances are expected to lead to a generation of long-range transports that cruise at supersonic or even hypersonic speeds. Current NASA/industry studies will define the market windows in terms of time frame, Mach number, and technology requirements for these aircraft. Initial results indicate that, for the years 2000 to 2020, economically attractive vehicles could have a cruise speed up to Mach 6. The resulting research challenges are unique. They must be met with technologies that will produce commercially successful and environmentally compatible vehicles where none have existed. Several important areas of research were identified for the high-speed civil transports. Among these are sonic boom, takeoff noise, thermal management, lightweight structures with long life, unique propulsion concepts, unconventional fuels, and supersonic laminar flow. Author

N87-27597*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
INVESTIGATION OF AIR TRANSPORTATION TECHNOLOGY AT MASSACHUSETTS INSTITUTE OF TECHNOLOGY, 1985
Robert W. Simpson *In* NASA, Langley Research Center, Joint University Program for Air Transportation Research, 1985 Jul. 1987 p 3-6 (For primary document see N87-27596 22-01)
Avail: NTIS HC A05/MF A01 CSCL 01C

N87-27598*# Massachusetts Inst. of Tech., Cambridge.
EXPERIMENTAL METHODOLOGIES TO SUPPORT AIRCRAFT ICING ANALYSIS
R. John Hansman, Jr. and Mark S. Kirby *In* NASA, Langley Research Center, Joint University Program for Air Transportation Research, 1985 Jul. 1987 p 7-25 (For primary document see N87-27596 22-01)
Avail: NTIS HC A05/MF A01 CSCL 01C

N87-27603*# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
INVESTIGATION OF AIR TRANSPORTATION TECHNOLOGY AT PRINCETON UNIVERSITY, 1985
Robert F. Stengel *In* NASA, Langley Research Center, Joint University Program for Air Transportation Research, 1985 Jul. 1987 p 55-61 (For primary document see N87-27596 22-01)
Avail: NTIS HC A05/MF A01 CSCL 01C

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Space Communications, Spacecraft Communications, Command and Tracking* and *Communications and Radar.*

N87-27652# Federal Aviation Administration, Atlantic City, N.J.
LORAN C VNAV (VERTICAL NAVIGATION) APPROACHES TO THE TECHNICAL CENTER HELIPORT
Michael Magrogan Mar. 1987 150 p
(AD-A182152; DOT/FAA/CT-TN86/56) Avail: NTIS HC A07/MF A01 CSCL 17G

This report documents the results of Loran C vertical navigation (VNAV) approaches to the Federal Aviation Administration (FAA) Technical Center Heliport. Results of this study show that the three dimensional (3D) Loran C Navigator met the requirements of Advisory Circular (AC) 90-45A for two dimensional (2D) error components of total system crosstrack (TSCT) and flight technical error (FTE). In addition, the 3D error component of vertical flight technical error (VFTE) met the requirements of AC 90-45A. GRA

N87-27599*# Ohio Univ., Athens.
GPS EXPERIMENTS
Samuel J. P. Laube *In* NASA, Langley Research Center, Joint University Program for Air Transportation Research, 1985 Jul. 1987 p 31-41 (For primary document see N87-27596 22-01)
Avail: NTIS HC A05/MF A01 CSCL 17G

N87-27600*# Ohio Univ., Athens.
LORAN-C MONITORING
Jamie Edwards *In* NASA, Langley Research Center, Joint University Program for Air Transportation Research, 1985 Jul. 1987 p 39-41 (For primary document see N87-27596 22-01)
Avail: NTIS HC A05/MF A01 CSCL 17G

N87-27602*# Ohio Univ., Athens.
INERTIAL/MULTISENSOR NAVIGATION
Dimitri Alikiotis *In* NASA, Langley Research Center, Joint University Program for Air Transportation Research, 1985 Jul. 1987 p 47-51 (For primary document see N87-27596 22-01)
Avail: NTIS HC A05/MF A01 CSCL 17G

N87-27607*# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
AN EXPERT SYSTEM FOR AIR TRAFFIC CONTROL SYSTEM
Takashi Sensui *In* NASA, Langley Research Center, Joint University Program for Air Transportation Research, 1985 Jul. 1987 p 99-103 (For primary document see N87-27596 22-01)
Avail: NTIS HC A05/MF A01 CSCL 17G

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.For land transportation vehicles see *85 Urban Technology and Transportation*.

N87-27653# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.

FUEL CONSERVATION EVALUATION OF US ARMY HELICOPTERS. PART 6: PERFORMANCE CALCULATOR EVALUATION Final Report, period ending Jan. 1981

Floyd Dominick and Roy A. Lockwood Jul. 1986 205 p

(AD-A181645; USAAEFA-81-01-6) Avail: NTIS HC A10/MF A01 CSCL 01B

The US Army Aviation Engineering Flight Activity conducted an evaluation of Flight Management Calculator for the UH-1H. The calculator was a Hewlett-Packard HP-41CV. The performance calculator was evaluated for flight planning and in-flight use during 14 mission flights simulating operational conditions. The calculator was much easier to use in-flight than the operator's manual data. The calculator program needs improvement in the areas of pre-flight planning and execution speed. The mission flights demonstrated a 19 percent fuel saving using optimum over normal flight profiles in warm temperatures (15 degrees C above standard). Savings would be greater at colder temperatures because of increasing compressibility effects. Acceptable accuracy for individual aircraft under operational conditions may require a regressive analog model in which individual aircraft data are used to update the program. The performance data base for the UH-1H was expanded with level flight and hover data to thrust coefficients and Mach numbers to the practical limits of aircraft operation. GRA

N87-27654# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

ON THE CONCEPTUAL DESIGN OF SUBSONIC TRANSPORT AIRCRAFT FOR CRUISING FLIGHT OPTIMIZED FOR DIFFERENT MERIT FUNCTIONS

E. Torenbeek Dec. 1985 53 p

(VTH-LR-451; B8707433; ETN-87-90200) Avail: NTIS HC A04/MF A01

An analytical approach to aircraft design optimization is presented. Design variables are mainly associated with wing design and powerplant sizing. Several figures of merit are studied as a function of the design variables and analytical expressions are derived for partial and combined optima. Merit functions are lift drag ratio, specific range, fuel plus powerplant weight as a fraction of the takeoff weight and of the design payload, fuel plus powerplant plus wing weight fraction, payload weight fraction, fuel burned per seat-km, and direct operating costs. The design variables studied are: engine size, (mean) cruise wing loading, pressure altitude, lift coefficient, Mach number, and wing aspect ratio. ESA

N87-27655*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

AIRCRAFT GROUND VIBRATION TESTING AT NASA AMES-DRYDEN FLIGHT RESEARCH FACILITY

Michael W. Kehoe Jul. 1987 21 p Presented at the 5th International Modal Analysis Conference, London, England, 6-9 Apr. 1987

(NASA-TM-88272; H-1374; NAS 1.15:88272) Avail: NTIS HC A02/MF A01 CSCL 01C

At the NASA Ames Research Center's Dryden Flight Research Facility at Edwards Air Force Base, California, a variety of ground vibration test techniques has been applied to an assortment of new or modified aerospace research vehicles. This paper presents a summary of these techniques and the experience gained from various applications. The role of ground vibration testing in the qualification of new and modified aircraft for flight is discussed. Data are presented for a wide variety of aircraft and component tests, including comparisons of sine-dwell, single-input random, and multiple-input random excitation methods on a JetStar airplane. Author

N87-27656# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

FATIGUE OF AIRCRAFT STRUCTURES

J. Schijve Apr. 1986 34 p Presented at the International Symposium on Fatigue Prevention and Design, Amsterdam, The Netherlands, 21-23 Apr. 1986

(VTH-LR-486; B8707459; ETN-87-90225) Avail: NTIS HC A03/MF A01

The various steps of fatigue analysis are indicated, including mission analysis and load spectra, conceptual aspects of designing against fatigue, predictions of fatigue lives and crack growth, and experimental verifications. The significance of fatigue load monitoring and flight-simulation testing is emphasized. ESA

N87-27657# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

DESIGN AND EVALUATION OF DYNAMIC FLIGHT TEST MANEUVERS

J. A. Mulder Oct. 1986 306 p

(VTH-LR-497; B8707465; ETN-87-90230) Avail: NTIS HC A14/MF A01

The kinematic, aerodynamic, and measurement error models used for flight tests are presented. Analysis of dynamic flight test data is discussed, and a technique for the optimization of control input signals is outlined. The flight test program, flight test measurement system, automatic control system, and the method used for measuring aicraft moments and products of inertia are described. Five types of longitudinal and lateral control input signals as implemented in flight, one of these being the result of the optimization technique are considered. The results of the flight test program are summarized. ESA

N87-27658# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.

LEVEL FLIGHT PERFORMANCE EVALUATION OF THE UH-60A HELICOPTER WITH THE PRODUCTION EXTERNAL STORES SUPPORT SYSTEM AND FERRY TANKS INSTALLED Final Report, 28 May - 19 Jun. 1986

Robert M. Buckanin, William A. Kelly, James L. Webre, Thomas L. Reynolds, and Roy A. Lockwood Sep. 1986 71 p

(AD-A181947; USAAEFA-86-01) Avail: NTIS HC A04/MF A01 CSCL 01C

Limited level flight performance testing was conducted on a sixth year production UH-60A helicopter equipped with a production external stores support system (EESS) and four preproduction external fuel tanks. These tests were conducted to provide the US Army Aviation Systems Command with level flight power required data to determine if the UH-60A would still meet the self deployment requirement described in the Material Need Document if the General Electric T700-GE-700 engines were replaced with T700-GE-701's. Sikorsky Aircraft Division of United Technologies Corporation claimed a drag reduction for the production ESSS over the prototype previously tested. A total of 13.9 productive flight hours were flown at Edwards AFB, and Bakersfield, California between 28 May and 19 June 1986. The installation of the production ESSS and four external fuel tanks increased the drag of the normal utility configured UH-60A by approximately 4.5 square feet of equivalent flat plate area. This represents a drag reduction of approximately 4.5 square feet for the production ESSS from the prototype ESSS previously tested. The takeoff characteristics were similar to a normal utility configured UH-60A and remain a shortcoming. GRA

N87-27659# Boeing Vertol Co., Philadelphia, Pa.

USE OF BLADE SWEEP TO REDUCE 4/rev HUB LOADS

Darrell K. Young, Frank J. Tarzanin, and Donald L. Kunz May 1987 11 p

(AD-A182247; AD-E951026) Avail: NTIS HC A02/MF A01 CSCL 01C

The effect of blade planform sweep on the 4/rev hub loads for a four-bladed, fully-articulated rotor was analytically investigated. Substantial vibratory hub load reductions could be achieved by using aft tip sweep. However, the mathematical model and the blade definition were too complex to understand the source of the reduction. To aid in understanding the physical mechanism, a model of a simplified blade was defined that still showed substantial hub load reductions. Using this simplified model, an extensive blade parameter sensitivity study was performed. It was determined that those properties which are related to the dynamic torsional response of the blade were important in determining the effectiveness of both aft and forward tip sweep in reducing the 4/rev vertical hub load. An extensive investigation into the source of the hub load reduction was performed, and a number of hypotheses were developed. GRA

N87-27660*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
APPLICATION OF GRASP (GENERAL ROTORCRAFT AEROMECHANICAL STABILITY PROGRAM) TO NONLINEAR ANALYSIS OF A CANTILEVER BEAM
Howard E. Hinnant and Dewey H. Hodges Apr. 1987 11 p
(NASA-TM-89222; NAS 1.15:89222; AD-A182324) Avail: NTIS HC A02/MF A01 CSCL 01A

The General Rotorcraft Aeromechanical Stability Program (GRASP) was developed to analyse the steady-state and linearized dynamic behavior of rotorcraft in hovering and axial flight conditions. Because of the nature of problems GRASP was created to solve, the geometrically nonlinear behavior of beams is one area in which the program must perform well in order to be of any value. Numerical results obtained from GRASP are compared to both static and dynamic experimental data obtained for a cantilever beam undergoing large displacements and rotations caused by deformations. The correlation is excellent in all cases. GRA

N87-27661*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. Ames Research Center.
DEMONSTRATION OF FREQUENCY-SWEEP TESTING TECHNIQUE USING A BELL 214-ST HELICOPTER
Mark B. Tischler, Jay W. Fletcher, Vernon L. Diekmann, Robert A. Williams, and Randall W. Cason Apr. 1987 83 p
(NASA Order-A-87073)
(NASA-TM-89422; NAS 1.15:89422; AD-A182361; USAAVSCOM-TM-87-A-1) Avail: NTIS HC A05/MF A01 CSCL 01C

A demonstration of frequency-sweep testing using a Bell-214ST single-rotor helicopter was completed in support of the Army's development of an updated MIL-H-8501A, and an LHX (ADS-33) handling-qualities specification. Hover and level-flight condition (Va = 0 knots and Va = 90 knots) tests were conducted in 3 flight hours by Army test pilots at the Army Aviation Engineering Flight Activity (AEFA) at Edwards AFB, Calif. Bandwidth and phase-delay parameters were determined from the flight-extracted frequency responses as required by the proposed specifications. Transfer-function modeling and verification demonstrates the validity of the frequency-response concept for characterizing closed-loop flight dynamics of single-rotor helicopters--even in hover. This report documents the frequency-sweep flight-testing technique and data-analysis procedures. Special emphasis is given to piloting and analysis considerations which are important for demonstrating frequency-domain specification compliance. GRA

N87-27662# Aeronautical Research Labs., Melbourne (Australia).
INTERPOLATION TECHNIQUES FOR THE TIME DOMAIN AVERAGING OF VIBRATION DATA WITH APPLICATION TO HELICOPTER GEARBOX MONITORING
P. D. McFadden Sep. 1986 39 p
(AD-A182572; ARL/AERO/PROP-TM-437) Avail: NTIS HC A03/MF A01 CSCL 01C

Interpolation techniques provide an alternative to the phase-locked frequency multiplier for the calculation of the time domain average of a vibration signal. Higher order interpolation techniques produce flatter passbands and lower sidelobes in the stopband but require longer calculation times. Aliasing errors are introduced into the result by replication of the sidelobes during interpolation. In general, the errors are attenuated by time domain averaging, but under some conditions may be passed without attenuation. GRA

N87-27663*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
FLUTTER CLEARANCE OF THE F-14 VARIABLE-SWEEP TRANSITION FLIGHT EXPERIMENT AIRPLANE, PHASE 1
Michael W. Kehoe Sep. 1987 68 p
(NASA-TM-88287; H-1402; NAS 1.15:88287) Avail: NTIS HC A04/MF A01 CSCL 01C

An F-14 airplane was modified to become the test bed aircraft for the variable sweep transition flight experiment (VSTFE) program. The latter is a laminar flow program designed to measure the effects of wing sweep on boundary layer transition from laminar to turbulent flow. The airplane was modified by adding an upper surface foam-fiberglass glove over a portion of the left wing. Ground vibration and flight flutter testing were accomplished to clear a sufficient flight envelope to conduct the laminar flow experiments. Flight test data indicated satisfactory damping levels and damping trends for the elastic structural modes of the airplane. The data presented include frequency and damping as functions of Mach number. Author

N87-27604*# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
OPTIMIZATION OF AIRCRAFT TRAJECTORIES THROUGH SEVERE MICROBURSTS
Mark L. Psiaki *In* NASA, Langley Research Center, Joint University Program for Air Transportation Research, 1985 Jul. 1987 p 63-72 (For primary document see N87-27596 22-01)
Avail: NTIS HC A05/MF A01 CSCL 01C

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

N87-27664# European Space Agency, Paris (France).
INVESTIGATION OF MAGNETOMETER ERRORS AND THEIR COMPENSATION IN THE BO-105 HELICOPTER
Hans-Juergen Hotop and Norbert Nawa Jan. 1987 63 p Transl. into ENGLISH of "Untersuchung des Fehlerverhaltens und der Kompensation eines Magnetometers im Hubschrauber BO-105, Brunswick, West Germany Original language document was announced as N87-11784
(ESA-TT-1015; DFVLR-FB-86-21; ETN-87-90013) Avail: NTIS HC A04/MF A01; original German version available from DFVLR, Cologne, West Germany DM 23.50

The errors of a magnetometer as a function of helicopter pitch and roll angles were investigated using flight test data. An error model for compensation is presented. The magnetometer was tested in different locations in the helicopter. Two possibilities of magnetometer error compensation are explained together with their accuracy as a mangetic sensor in an attitude and heading reference system. The use of an on-line algorithm allows compensation during the flight, and leads to an improvement of the magnetic attitude information with increasing flight time. ESA

N87-27665*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INTEGRATION OF ALTITUDE AND AIRSPEED INFORMATION INTO A PRIMARY FLIGHT DISPLAY VIA MOVING-TAPE FORMATS: EVALUATION DURING RANDOM TRACKING TASK
Terence S. Abbott, Mark Nataupsky, and George G. Steinmetz Sep. 1987 19 p

(NASA-TM-4010; L-16309; NAS 1.15:4010) Avail: NTIS HC A02/MF A01 CSCL 01D

A ground-based aircraft simulation study was conducted to determine the effects on pilot preference and performance of integrating airspeed and altitude information into an advanced electronic primary flight display via moving-tape (linear moving scale) formats. Several key issues relating to the implementation of moving-tape formats were examined in this study: tape centering, tape orientation, and trend information. The factor of centering refers to whether the tape was centered about the actual airspeed or altitude or about some other defined reference value. Tape orientation refers to whether the represented values are arranged in descending or ascending order. Two pilots participated in this study, with each performing 32 runs along seemingly random, previously unknown flight profiles. The data taken, analyzed, and presented consisted of path performance parameters, pilot-control inputs, and electrical brain response measurements. Author

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxilliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N87-27666*# Stanford Univ., Calif. Joint Inst. for Aeronautics and Acoustics.

A COMPUTATIONAL STUDY OF THRUST AUGMENTING EJECTORS BASED ON A VISCOUS-INVISCID APPROACH

Thomas S. Lund, Domingo A. Tavella, and Leonard Roberts May 1987 262 p

(Contracts NCC2-150; NCC2-309)

(NASA-CR-181205; NAS 1.26:181205; JIAA-TR-77) Avail: NTIS HC A12/MF A01 CSCL 21E

A viscous-inviscid interaction technique is advocated as both an efficient and accurate means of predicting the performance of two-dimensional thrust augmenting ejectors. The flow field is subdivided into a viscous region that contains the turbulent jet and an inviscid region that contains the ambient fluid drawn into the device. The inviscid region is computed with a higher-order panel method, while an integral method is used for the description of the viscous part. The strong viscous-inviscid interaction present within the ejector is simulated in an iterative process where the two regions influence each other en route to a converged solution. The model is applied to a variety of parametric and optimization studies involving ejectors having either one or two primary jets. The effects of nozzle placement, inlet and diffuser shape, free stream speed, and ejector length are investigated. The inlet shape for single jet ejectors is optimized for various free stream speeds and Reynolds numbers. Optimal nozzle tilt and location are identified for various dual-ejector configurations. Author

N87-27667# Rolls-Royce Ltd., Derby (England).

APPLICATION OF SPATE TO HIGH FREQUENCY VIBRATION MEASUREMENT OF AERO ENGINE COMPONENTS

Stephen R. Turner and Neville G. Pollard 17 Feb. 1987 17 p Presented at the 2nd International Conference on Stress Analysis by Thermoelastic Techniques, 7-18 Feb. 1987

(PNR90373; ETN-87-90114) Copyright Avail: NTIS HC A02/MF A01

The application of a full field vibration stress measurement technique over the range 30 Hz to 5 kHz on blades and high energy components is described. The measurements were made to: validate a finite element model; measure the effect of local modifications; and solve development incidents. The relative successes of measuring at different frequencies are discussed. Full field stress measurements using Stress Pattern Analysis by Thermal Emission in the vibration investigation and its relation to other measurement techniques are summarized. ESA

N87-27668# Rolls-Royce Ltd., Derby (England).

SURFACE MOUNTED TEMPERATURE SENSORS

K. W. Stringfellow 4 Feb. 1987 37 p Presented at the Technical Lecture on British Rail Course, Derby, England

(PNR90380; ETN-87-90115) Copyright Avail: NTIS HC A03/MF A01

Surface temperature measurement using electrical methods and physical/chemical change methods is reviewed. Thermocouples, resistance mats, color change materials, hardness changers, liquid crystals, and unmounted sensors are described. ESA

N87-27669# Rolls-Royce Ltd., Derby (England). Advanced Projects Dept.

THE APPLICATION OF RADIATION PHYSICS AND PHOTOGRAMMETRIC TECHNIQUES FOR THE DIAGNOSIS AND SOLUTION OF MECHANICAL ENGINEERING PROBLEMS AND PERFORMANCE IMPROVEMENTS IN THE DEVELOPMENT OF AERO GAS TURBINE ENGINES AT ROLLS-ROYCE

P. A. E. Stewert 19 May 1986 20 p Presented at the 67th AGARD PEP Symposium, Philadelphia, Penn., 19-23 May 1986 Previously announced as N87-21198

(PNR90388; ETN-87-90116) Copyright Avail: NTIS HC A02/MF A01

High Energy (8 MeV) X-rays were used to determine metal component movements for engine performance improvements and integrity confirmation, using film. Real time video was used for transient events. Low energy X-rays with high speed cine fluoroscopy were used to analyze molten metal flows in the turbine blade casting process. Cold neutrons and low energy X-rays were used to analyze two phase flows and oil distribution in an engine oil scavenge system. Positron emitting isotope techniques are being developed to determine fuel and lubrication system dynamics. The images captured by these systems are processed by digital techniques, and pattern recognition and cross correlation is carried out. Measurements are made from the film and video images using two and three dimensional photogrammetric methods. ESA

N87-27670# Rolls-Royce Ltd., Derby (England).

ADVANCED TECHNOLOGY AND ITS APPLICATION TO AERO ENGINES

P. C. Ruffles and T. Broughton 29 Jan. 1987 9 p Presented at the 15th GTSJ Gas Turbine Seminar, Japan, 29 Jan. 1987

(PNR90389; ETN-87-90117) Copyright Avail: NTIS HC A02/MF A01

Development trends in civil and military aircraft engines are reviewed. Honeycomb blades, turboshafts, fuel consumption, propulsive efficiency, and thrust/weight ratios are discussed. ESA

N87-27671# Rolls-Royce Ltd., Derby (England).

THE ROLLS-ROYCE WIDE CHORD FAN BLADE

G. A. Fitzpatrick and T. Broughton 19 Oct. 1986 19 p Presented at the International Conference on Titanium Products and Applications, San Francisco, Calif., 19-22 Oct. 1986

(PNR90392; ETN-87-90118) Copyright Avail: NTIS HC A02/MF A01

A highly efficient fan for civil engine applications in the thrust range 22,000 to 58,000 lbs was developed. It is snubberless, hollow, and of wide chord. Its manufacturing method, particularly diffusion bonding, and component and metallurgical integrity, is described. ESA

N87-27672# Institute for Defense Analyses, Alexandria, Va.

POLICY OPTIONS FOR THE AIRCRAFT TURBINE ENGINE COMPONENT IMPROVEMENT PROGRAM Final Report, Dec. 1986 - May 1987

J. R. Nelson, Bruce R. Harmon, and Karen W. Tyson May 1987 110 p

(Contract MDA903-84-C-0031)

(AD-A182727; AD-E500873; IDA-P-2015; IDA/HQ-87-32146) Avail: NTIS HC A06/MF A01 CSCL 01C

The aircraft turbine engine Component Improvement Program (CIP) is an important element in the acquisition and maturation of engines for military aircraft and helicopter applications. This report presents the results of an investigation into the role of CIP, its value to the military services, and the feasibility and practicality of certain policy options including: (1) transitioning CIP to the private sector, (2) competing CIP in whole or in part, and (3) comparing CIP to airframe and avionics engineering change processes. Recommendations for future actions are included. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

For related information see also *05 Aircraft Design, Testing and Performance.*

N87-27673 Purdue Univ., West Lafayette, Ind.
AN INTERACTIVE SYNTHESIS APPROACH FOR ROBUST ACTIVE FLUTTER SUPPRESSION CONTROL LAW DESIGN Ph.D. Thesis
Ta Kang Chen 1986 275 p
Avail: Univ. Microfilms Order No. DA8709786

Computer-aided, graphical, frequency-domain synthesis approach is employed in the control law design process for robust active flutter suppression (AFS). The relatively high dynamic order of such problems are dealt with effectively with a computer-aided approach, while interactive computer graphics allows frequency-domain graphical techniques to be utilized. Key design information is displayed for variations in flight conditions such that simple control laws are obtained that are robust over various flight conditions under consideration. Through visualization of the pole and zero migration with dynamic pressure, control synthesis, evaluation can be performed almost by inspection. Several candidate control laws are analytically shown to compare very favorably to several others taken from the literature. For the AFS problem, it is found that the aeroelastic mode dipole orientations significantly impact the easiness in the control synthesis process and the possibly achievable overall system performance and controller robustness. The selection of sensor location plays an important role in the determination of advantageous dipole orientations. Dissert. Abstr.

N87-27605*# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
FAULT-TOLERANT FLIGHT CONTROL SYSTEM COMBINING EXPERT SYSTEM AND ANALYTICAL REDUNDANCY CONCEPTS
Dave Handelman *In* NASA, Langley Research Center, Joint University Program for Air Transportation Research, 1985 Jul. 1987 p 73-85 (For primary document see N87-27596 22-01)
Avail: NTIS HC A05/MF A01 CSCL 01C

N87-27606*# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
EFFECTS OF JOINT RATE AND DISPLACEMENT CONSTRAINTS ON STABILITY REGIONS
P. C. Shrivastava *In* NASA, Langley Research Center, Joint University Program for Air Transportation Research, 1985 Jul. 1987 p 87-97 (For primary document see N87-27596 22-01)
Avail: NTIS HC A05/MF A01 CSCL 01C

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N87-27674# National Bureau of Standards, Gaithersburg, Md. Automated Production Technology Div.
DESCRIPTION OF NBS (NATIONAL BUREAU OF STANDARDS) CALIBRATION SERVICES IN MECHANICAL VIBRATION AND SHOCK
D. C. Robinson, M. R. Serbyn, and B. F. Payne Feb. 1987 39 p (PB87-180394; NBS/TN-1232) Avail: NTIS HC A03/MF A01; also availableSOD HC $1.50 as 003-003-02794-4 CSCL 14B

Accurate calibration of accelerometers requires that accurate measurement techniques be developed and maintained. Calibration of vibration exciters and pickups are performed by comparison with the response characteristics of NBS standard accelerometers or by absolute methods. The paper gives a summary of the various procedures used in the calibration of accelerometers and reference exciters. The frequency ranges, vibration levels, and accuracy statements for standardized tests designed to meet a variety of user needs are listed. GRA

N87-27675# Illinois Univ., Urbana. Civil Engineering Lab.
DEVELOPMENT OF MECHANISTIC FLEXIBLE PAVEMENT DESIGN CONCEPTS FOR THE HEAVYWEIGHT F-15 AIRCRAFT Final Report, Aug. 1983 - May 1986
Henry F. Kelly Sep. 1986 228 p
(Contract F08637-85-M-6023)
(AD-A181596; AFESC/ESL-TR-86-32) Avail: NTIS HC A11/MF A01 CSCL 01E

This technical report describes a mechanistic method proposed for design of flexible airfield pavements. The report reviews the CBR Flexible Airfield Pavements Design currently used by DOD and the FAA. Then follows a description of the ILLIPAVE finite element computer model and pavement performance transfer functions developed using ILLIPAVE. Actual test data using aircraft-sized loads was used to correlate the constants used in the computer model. The proposed method was then used to design a flexible pavement to support a heavyweight F-15 (30,600 lb SWL, 355 psi). Finally, the subsequent design is compared to the design resulting from the CBR method. GRA

N87-27676# European Space Agency, Paris (France).
OPTIMAL CONTROL: A SYSTEMATIC DEVICE FOR THE COMPUTER-AIDED EXPLORATION OF THE DYNAMIC POSSIBILITIES OF A CRYOGENIC WIND TUNNEL
Dieter Kraft Mar. 1987 228 p Transl. into ENGLISH of "Optimalsteurungen - ein systemtisches Hilfsmittel zur Rechnergestuetzten Erforschung der Dynamischen Moeglichkeiten eines Tieftemperaturwindkanals, Oberpfaffenhofen, West Germany Original language document was announced as N87-10879
(ESA-TT-1016; DFVLR-FB-86-23; ETN-87-90014) Avail: NTIS HC A11/MF A01; original German version available from DFVLR, Cologne, West Germany DM 63

The dynamic systems behavior of a cryogenic wind tunnel was analyzed for an automatic control system which meets the safety requirements and operating specifications in a wide domain of operations. For cost, safety, and availability reasons this analysis cannot be performed on the real tunnel, but must be conducted on a mathematical model. The dynamic behavior of the wind tunnel is characterized by strongly coupled nonlinear differential equations; therefore optimal control was applied for analysis. The boundary values of the system are the basis of comparison for the different steps of the analysis, while the control and state constraint and their variations resulting from the operating specifications represent systematic step sizes along which the dynamic spectrum was

explored. This procedure yields statements about the robustness of nonlinear systems. Direct numerical methods for the solution of optimal control problems are described. ESA

N87-27677# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction de l'Aerodynamique.
SEARCH FOR A PRINCIPLE TO GENERATE HIGH FREQUENCY GUSTS Final Report [RECHERCHE D'UN PRINCIPE DE GENERATEUR DE RAFALES HAUTE FREQUENCE]
H. Consigny Mar. 1986 59 p In FRENCH
(Contract DRET-85-34-001)
(ONERA-RSF-92/1865-AY; ETN-87-90125) Avail: NTIS HC A04/MF A01

Gust generators of three different kinds were tested in a small (180x180 mm) wind tunnel. These were resonant cavities, fixed spoilers, and rotating cams mounted on the wall. The measurements carried out with laser velocimeters and clinometric transducers show that the cam device generates gusts of 1 to 3 deg amplitude and frequency up to 600 Hz with acceptable homogeneity. ESA

N87-27678*# Old Dominion Univ., Norfolk, Va. Dept. of Electrical and Computer Engineering.
SUPPORT OF THE EIGHT-FOOT HIGH TEMPERATURE TUNNEL MODIFICATION PROJECT Final Report, period ended 16 Aug. 1987
Kim Chi Ngo and Roland R. Mielke Aug. 1987 28 p
(Contract NAS1-17993)
(NASA-CR-181280; NAS 1.26:181280) Avail: NTIS HC A03/MF A01 CSCL 14B

In order to meet the need for propulsion testing in the high supersonic range from Mach 4 to Mach 7, NASA has undertaken the modification of the Langley Eight Foot High Temperature Tunnel to add alternate Mach number capability and oxygen enrichment to allow the testing of operating engines at these Mach numbers and at true temperature tunnel. The transfer of liquid oxygen (LOX) from a storage vessel to a rocket engine generally requires the use of a pressurizing gas at high pressures. Although nitrogen is preferred, unfortunately, when gaseous nitrogen (GN2) is used as the pressurant to transfer liquid oxygen from a storage tank to the tunnel combustor, it contaminates the liquid oxygen and effects a loss of performance in the engine. The contamination of the LOX by the pressurizing GN2 is described, which may prove to be an important operational constraint. It is desirable to have reliable data concerning the penetration of GN2 into LOX during pressurization and the subsequent of self cleaning after blowdown. Author

N87-27679# Sandia National Labs., Albuquerque, N. Mex.
VAWT STOCHASTIC WIND SIMULATOR
J. H. Strickland Apr. 1987 55 p
(Contract DE-AC04-76DP-00789)
(DE87-010532; SAND-87-0501) Avail: NTIS HC A04/MF A01

A stochastic wind simulation for VAWTs (VSTOC) has been developed which yields turbulent wind-velocity fluctuations for rotationally sampled points. This allows three-component wind-velocity fluctuations to be simulated at specified nodal points on the wind-turbine rotor. A first-order convection scheme is used which accounts for the decrease in streamwise velocity as the flow passes through the wind-turbine rotor. The VSTOC simulation is independent of the particular analytical technique used to predict the aerodynamic and performance characteristics of the turbine. The VSTOC subroutine may be used simply as a subroutine in a particular VAWT prediction code or it may be used as a subroutine in an independent processor. The independent processor is used to interact with a version of the VAWT prediction code which is segmented into deterministic and stochastic modules. Using VSTOC in this fashion is very efficient with regard to decreasing computer time for the overall calculation process. DOE

N87-27680*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TIME-AVERAGED AERODYNAMIC LOADS ON THE VANE SETS OF THE 40- BY 80-FOOT AND 80- BY 120-FOOT WIND TUNNEL COMPLEX
Kiyoshi Aoyagi, Lawrence E. Olson, Randall L. Peterson, Gloria K. Yamauchi, James C. Ross, and Thomas R. Norman Aug. 1987 190 p
(NASA-TM-89413; A-87039; NAS 1.15:89413) Avail: NTIS HC A09/MF A01 CSCL 14B

Time-averaged aerodynamic loads are estimated for each of the vane sets in the National Full-Scale Aerodynamic Complex (NFAC). The methods used to compute global and local loads are presented. Experimental inputs used to calculate these loads are based primarily on data obtained from tests conducted in the NFAC 1/10-Scale Vane-Set Test Facility and from tests conducted in the NFAC 1/50-Scale Facility. For those vane sets located directly downstream of either the 40- by 80-ft test section or the 80- by 120-ft test section, aerodynamic loads caused by the impingement of model-generated wake vortices and model-generated jet and propeller wakes are also estimated. Author

N87-27681*# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
HIGH ANGLE OF ATTACK POSITION SENSING FOR THE SOUTHAMPTON UNIVERSITY MAGNETIC SUSPENSION AND BALANCE SYSTEM Progress Report, Jan. 1986 - Mar. 1987
David H. Parker Aug. 1987 38 p
(Grant NsG-7523)
(NASA-CR-178358: NAS 1.26:178358; AASU-87/3) Avail: NTIS HC A03/MF A01 CSCL 14B

An all digital five channel position detection system is to be installed in the Southampton University Magnetic Suspension and Balance System (SUMSBS). The system is intended to monitor a much larger range of model pitch attitudes than has been possible hitherto, up to a maximum of a 90 degree angle of attack. It is based on the use of self-scanning photodiode arrays and illuminating laser light beams, together with purpose built processing electronics. The principles behind the design of the system are discussed, together with the results of testing one channel of the system which was used to control the axial position of a magnetically suspended model in SUMSBS. The removal of optically coupled heave position information from the axial position sensing channel is described. Author

N87-27682# Air Force Armament Lab., Eglin AFB, Fla.
DESCRIPTION AND CAPABILITIES OF THE AEROBALLISTIC RESEARCH FACILITY Final Technical Report, Jan. 1979 - Jan. 1987
Robert L. Kittyle, James D. Packard, and G. L. Winchenbach May 1987 57 p
(AD-A182346; AD-E801510; AFATL-TR-87-08) Avail: NTIS HC A04/MF A01 CSCL 14B

The Aeroballistic Research Facility located at Eglin AFB, Fla., and the instrumentation systems contained in the facility are discussed along with the data analysis techniques used. Typical data for various configurations that have been tested within the facility are presented. The facility is a classic free-flight spark range containing orthogonal shadowgraph stations, corresponding chronograph system, and several supporting systems. The free-flight trajectories of various configurations are experimentally measured and analyzed using both linear theory techniques and nonlinear numerical integration methods. Typical results for a spin stabilized projectile, statically stable (fin) missile, and an aircraft model are presented for illustrative purposes. The facility has undergone numerous changes and improvements since it became operational in 1976 and it is expected that this process will continue into the future. GRA

N87-27683# Naval Training Systems Center, Orlando, Fla.
GUIDELINES FOR ALLEVIATION OF SIMULATOR SICKNESS SYMPTOMATOLOGY Final Report

R. S. Kennedy, K. S. Berbaum, M. G. Lilienthal, W. P. Dunlap, and B. E. Mulligan Mar. 1987 72 p
(AD-A182554; NAVTRASYSCEN-TR-87-007) Avail: NTIS HC A04/MF A01 CSCL 06J

Ground-based flight simulators train effectively and at relatively low cost, but simulator sickness may compromise their utility. In the U.S. Navy, simulator sickness is reported with increasing frequency. Instructors complain that such distress may interfere with simulator use and reduce the effectiveness of training. Operational effectiveness is compromised by flight restrictions subsequent to training in some simulators. Field studies conducted over the last two years at 10 flight simulator sites showed incidence rates ranged from 12% to 60% for these simulators. A data base is being assembled to discover whether the incidence of symptoms is related to specific equipment features or syllabus demands that require a variety of motion characteristics (i.e., hover, air combat, jinking). Wide field of view, distortion, cue asynchrony, and very low frequency vibration also appear to be contributing factors. A cross-disciplinary biomedical engineering panel was convened to discuss the problem. The recommendations of this panel are given. Research literature related both to the findings of the data base survey and to the recommendations has been integrated into this report. GRA

N87-27684# Office of Naval Research, London (England).
FACILITIES AND RESEARCH AT THE FRENCH-GERMAN INSTITUTE OF RESEARCH
Daniel J. Collins 12 Jun. 1987 7 p
(ONRL-7-017-R) Avail: NTIS HC A02/MF A01

The Institute of Research at St. Louis, France, is involved in research in ballistics, the chemistry of explosives and detonations, the aerodynamics of wings and slender bodies, acoustics, lasers, and measuring techniques. A review is given of the facility and of some of the research. Author

N87-27685*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CRYOGENIC WIND TUNNELS: A SELECTED, ANNOTATED BIBLIOGRAPHY
Marie H. Tuttle (Vigyan Research Associates, Inc., Hampton, Va.), Robert A. Kilgore, and Karen L. Cole Sep. 1987 92 p Supersedes NASA-TM-86346; NASA-TM-80168; and NASA-TM-84474
(NASA-TM-4013; L-16367; NAS 1.15:4013) Avail: NTIS HC A05/MF A01 CSCL 14B

This bibliography contains 478 entries. It updates and supersedes previous NASA bibliographies on cryogenic wind tunnels. This updated version cites 102 additional documents. The intent is to list publications that would be useful to persons interested in building or using a cryogenic wind tunnel. Author

N87-27686# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SLED TRACK: BALLISTICS [TRILHO DE ENSAIOS: BALISTICA]
Walter Gill, Joao AndradedeCarvalhoJunior, and Demetrio BastosNetto Feb. 1987 18 p In PORTUGUESE; ENGLISH summary Submitted for publication
(INPE-4116-NTE/267) Avail: NTIS HC A02/MF A01

A rocket sled track is an indispensible research tool for the development of modern military and aerospace equipment. In application, a test object is mounted on a sled chassis running on precision steel rails and accelerated by rockets and decelerated by water scoops. This captive track testing of full scale aircraft and missile component makes possible the recovery of expensive test sections, facilitates the instrumentation of the tests, and provides a degree of repeatability not normally achieved under conditions of free flight. The basic ballistic equations of motion on the track are reviewed for use in the preliminary layout of such a track facility. Author

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N87-27687# Joint Publications Research Service, Arlington, Va.
USSR REPORT: SPACE
21 Apr. 1986 140 p Transl. into ENGLISH from various Russian articles
(JPRS-USP-86-004) Avail: NTIS HC A07/MF A01

Topics addressed include: manned mission highlights, space sciences, interplanetary sciences, life sciences, space engineering, space applications, space policy and administration, and launch table. For individual titles, see N87-27688 through N87-27696.

N87-27688# Joint Publications Research Service, Arlington, Va.
PRAVDA COMMENTARY, PHOTOS OF MIR ORBITAL STATION **c18**
A. Pokrovskiy *In its* USSR Report: Space 21 Apr. 1986 p 3-8 Transl. into ENGLISH from Pravda (USSR), 21 Feb. 1986 p 1; 3 (For primary document see N87-27687 22-12)
Avail: NTIS HC A07/MF A01

The Mir and Salyut space stations are compared, relative to mission accomplishments, docking ability, cabin space, crew comfort, efficiency, and crew productivity. B.G.

N87-27689# Joint Publications Research Service, Arlington, Va.
SCIENTIFIC DIRECTOR OF INTERSHOCK PROJECT ON PROGNOZ-10 RESULTS **c90**
Albert Galeyev *In its* USSR Report: Space 21 Apr. 1986 p 33-36 Transl. into ENGLISH from APN: Advances of Science and Technology (Moscow, USSR), no. 22, 20 Nov. 1985 p 1-5 (For primary document see N87-27687 22-12)
Avail: NTIS HC A07/MF A01

The Prognoz-10 research satellite is one of a series of high-apogee satellites which were launched with the task of studying solar activity and resulting impact on near-earth space. The results of the research are discussed. B.G.

N87-27690# Joint Publications Research Service, Arlington, Va.
CONFERENCE DISCUSSES VEGA RESULTS, PLANS FOR PHOBOS MISSION
V. Konovalov *In its* USSR Report: Space 21 Apr. 1986 p 47-49 Transl. into ENGLISH from Izvestiya (Moscow, USSR), 14 Nov. 1985 p 1; 3 (For primary document see N87-27687 22-12)
Avail: NTIS HC A07/MF A01

Data acquired by Vega 1 and 2 orbiting Venus are discussed. Future plans for Mars, Deimos, and Phobos are examined. B.G.

N87-27691# Joint Publications Research Service, Arlington, Va.
PLANS FOR PHOBOS MISSION DISCUSSED
B. Konovalov *In its* USSR Report: Space 21 Apr. 1986 p 50-52 Transl. into ENGLISH from Nedelya (Moscow, USSR), no. 47, 18-24 Nov. 1985 p 17 (For primary document see N87-27687 22-12)
Avail: NTIS HC A07/MF A01

Two automatic stations, which are being developed for the Phobos Project, will be able to use a broad set of international instruments and to investigate the surface, atmosphere, ionosphere, and magnetosphere of Mars from a satellite orbit. After complex maneuvers, both stations will transfer to a circular orbit, extremely near Phobos. Mission plans are discussed. B.G.

N87-27692# Joint Publications Research Service, Arlington, Va.
GRISHIN ON DEVELOPMENT OF ORBITAL PRODUCTION FACILITIES **c29**
Yu. Meshkov *In its* USSR Report: Space 21 Apr. 1986 p 62-66 Transl. into ENGLISH from NTR: Problemy i Resheniya (Moscow, USSR), no. 2, 21 Jan. - 3 Feb. 1986 p 8 (For primary document see N87-27687 22-12)
Avail: NTIS HC A07/MF A01

Space technology is exerting a notable influence on machine building, electronics, radio technology, optics, laser technology, and other sectors. Their growing requirements confront the

technologists with the necessity of making practical use of outer space for industrial purposes. Future trends are discussed. B.G.

N87-27693# Joint Publications Research Service, Arlington, Va.
IKI DEPARTMENT HEAD ON ORBITAL POWER PLANTS c44
Yuriy Zaitsev *In its* USSR Report: Space 21 Apr. 1986 p 67-69 Transl. into ENGLISH from APN: Advances of Science and Technology (Moscow, USSR), no. 22, 20 Nov. 1985 p 1-4 (For primary document see N87-27687 22-12)
Avail: NTIS HC A07/MF A01

The depleting resources of fossil fuels and mankind's growing demand for energy necessitate the search for new sources of energy and revision of the approach to the old ones. The creation of solar power plants in near-earth orbit is discussed as a solution to the problem. B.G.

N87-27694# Joint Publications Research Service, Arlington, Va.
COMPUTER SYSTEM FOR CONTROLLING, ACQUIRING, RECEIVING AND TRANSMITTING SCIENTIFIC INFORMATION ON VEGA-1 AND VEGA-2 SPACECRAFT c19
Vyacheslav Mikhaylov Balebanov, V. D. Glazkov, V. M. Linkin, and B. A. Novikov *In its* USSR Report: Space 21 Apr. 1986 p 70-87 Transl. into ENGLISH from Novoye v Zhizni, Nauke, Tekhnike: Seriya Kosmonavtike, Astronomiya (Moscow, USSR), no. 10, Oct. 1985 p 26-47 (For primary document see N87-27687 22-12)
Avail: NTIS HC A07/MF A01

Reconnaissance of large bodies of the solar system by means of automatic interplanetary stations and research on small bodies, are considered as basic trends in the development of space research for now and in the near term. A computer system was developed for controlling, acquiring, and transmitting scientific information that makes it possible under conditions of rigid demands on reliability, mass, and power consumption to control the functioning of scientific instruments by means of functional and numerical commands, as well as to acquire and transmit scientific information for recording to on-board memory units of the TM-3072 low-speed telemetry system and to a direct transmission channel on a real time basis by a low-speed radio link at a rate of 3,072 bits per second and by a high-speed radio link at a rate of 65,536 bits per second. The information system is described, as well as the equipment required. B.G.

N87-27695# Joint Publications Research Service, Arlington, Va.
PROGRESS IN THEORY, TECHNOLOGY OF SPACE MATERIALS SCIENCE c29
Yu. Osipyan *In its* USSR Report: Space 21 Apr. 1986 p 97-99 Transl. into ENGLISH from Pravda (Moscow, USSR), 12 Nov. 1985 p 3 (For primary document see N87-27687 22-12)
Avail: NTIS HC A07/MF A01

The crews on the Salyut-6 station conducted more than 200 melts and almost as many operations on spraying gold, copper, and various alloys and produced about 300 samples of various materials. Technical experiments now being conducted aboard the Salyut-7 are an important stage in the development of space materials science. Soviet scientists together with specialists from France, are creating equipment which must meet modern requirements from the gas phase and is distinguished by highly accurate temperature maintenance. Another unit is being created through co-operation of Soviet and British scientist. Its intended to study processes of low temperature crystallization out of solutions and promising methods of obtaining crystals of practical value. B.G.

N87-27696# Joint Publications Research Service, Arlington, Va.
SUCCESSES OF COSMOS-1500 SATELLITE, SLR SYSTEM c43
Yuriy Andreotti *In its* USSR Report: Space 21 Apr. 1986 p 100-103 Transl. into ENGLISH from APN: Advances of Science and Technology (Moscow, USSR), no. 21, 5 Nov. 1985 p 1-5 (For primary document see N87-27687 22-12)
Avail: NTIS HC A07/MF A01

Some of the results obtained from the Soviet artificial Earth satellite Cosmos-1500 during its two years in orbit are described. Author

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbital and launching dynamics.

N87-27697# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A SYSTEM OF SOFTWARE MANAGEMENT FOR ORBIT AND ATTITUDE CONTROL OF SATELLITES, BASED UPON A DECISION TABLE, FOR A MULTIMISSION CONTROL CENTER M.S. Thesis [UM SISTEMA DE GERENCIAMENTO DE SOFTWARE PARA O CONTROLE DE ORBITA E ATITUDE DE SATELITES, BASEADO EM TABELAS DE DECISAO, PARA UM CENTRO DE CONTROLE MULTIMISSAO]
Paulo Giacomo Milani May 1987 181 p In PORTUGUESE; ENGLISH summary
(INPE-4165-TDL/271) Avail: NTIS HC A09/MF A01

A structure for the control of space missions is proposed utilizing a management concept based on a Decision Table converted to its associated Decision Tree. A study is made initially of Decision Tables and their corresponding conversion to Decision Trees. The modules making up the system are presented in reverse order, with every input and output made explicit at the last level of decomposition. Then the management structure (based on the Decision Table) is presented down to the level of its component routines. The structure appears to be applicable to multimission control centers and displays good characteristics for adaption to new missions. Author

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air).*

N87-27698# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Space Div.
PRELIMINARY STUDY OF A BIOLOGICAL AND BIOCHEMICAL ANALYSIS FACILITY (BBAF) FOR COLUMBUS: EXECUTIVE SUMMARY Final Report
Paris, France ESA Nov. 1985 44 p Prepared in cooperation with Brunel Univ., Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost, The Netherlands, ORS, Vienna, Austria, and Technical Univ., Graz, Austria
(Contract ESA-6607/85-F-HEW)
(ESA-CR(P)-2338; ETN-87-99987) Avail: NTIS HC A03/MF A01

The feasibility of a compact space laboratory for the performance of complex biological and biochemical assays in a microgravity environment is shown. The laboratory will provide service and support functions to other life science facilities in a common life science mission onboard the pressurized module of Colombus Space Station. Solution to problems due to the use of commercial hardware (for cost reasons) that may cause incompatibility problems (different electronics, etc.) and the limited resources of crew time available are proposed. ESA

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles.

For related information see also *20 Spacecraft Propulsion and Power.*

No abstracts in this category.

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques.

For related information see also *03 Air Transportation and Safety* and *18 Spacecraft Design, Testing and Performance.* For space suits see *54 Man/System Technology and Life Support.*

N87-27699# Committee on Commerce, Science, and Transportation (U.S. Senate).

SPACE SHUTTLE OVERSIGHT

Washington GPO 1987 170 p Hearing before the Subcommittee on Science, Technology and Space of the Committee on Commerce, Science and Transportation, 100th Congress, 1st Session, 22 Jan. 1987

(S-Hrg-100-159; GPO-72-663) Avail: Subcommittee on Science, Technology and Space

The organizational management changes, the status of the shuttle recovery activities, and the status of the solid rocket motor redesign activities are discussed. B.G.

17 SPACE COMM., SPACECRAFT COMM., COMMAND & TRACKING

Includes telemetry; space communications networks; astronavigation and guidance; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications and Radar.*

N87-27700# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.

A SIMULATION TOOL FOR THE STUDY OF SATELLITE BASED NAVIGATION SYSTEMS

P. J. dePagter, G. J. Dekker, and L. J. M. Joosten 21 Apr. 1986 13 p Presented at the 15th International Symposium on Space Technology and Science, Tokyo, Japan, 18-24 May 1986

(Contract ESA-5649/83-D-JS(SC))

(NLR-MP-86030-U; B8701678; ETN-87-99188) Avail: NTIS HC A02/MF A01

A NAVAST simulation tool was developed. It consists of a library with independent models that simulate a specific part of the NAVSAT system. Each model has precise defined interfaces and communicates with other models via time-tagged messages. The internal actions in a model can be chosen at will without affecting other models. A simulator building tool composes specific simulators from selected models out of the library. The fixed core of these simulators consists of a message-routing system that controls the dataflow between models. Ground segment models; spacecraft orbit models, including realistic orbit perturbations; ionospheric propagation models, based on the Bent model; and user receiver models including the solution of the navigation equations based on nonlinear filtering techniques are included. Simulation results indicate that the worldwide navigation accuracy of NAVSAT will be 10 to 15 m. The models can also simulate satellite telemetry processing, liquid sloshing, and air traffic control. ESA

N87-27701# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.

DISTRIBUTED SENSOR NETWORKS Semiannual Technical Summary Report, 1 Apr. - 30 Sep. 1986

Richard T. Lacoss 30 Sep. 1986 35 p

(Contract F19628-85-C-0002)

(AD-A182216; ESD-TR-86-196) Avail: NTIS HC A03/MF A01 CSCL 17A

The Distributed Sensor Networks (DSN) program was aimed at developing distributed target surveillance and tracking methods for systems employing multiple spatially distributed sensors and processing resources. Such systems would be made up of sensors, data bases, and processors distributed throughout an area and interconnected by an appropriate digital data communication system. The hypothesis of the program was that through netting and distributed processing, the information from many sensors could be combined to yield effective surveillance systems. The overall concept called for a mix of sensor types as well as geographically distributed sensors. Surveillance and tracking of low-flying aircraft with ground-based acoustic and imaging sensors was used to develop and evaluate DSN concepts in the light of a specific problem. An experimental DSN testbed system was developed and has been used to test and demonstrate DSN techniques. Small arrays of microphones providing directional information were employed as acoustic sensors and visible TV cameras were used as imaging sensors in the testbed system. The primary accomplishment during this final report period was the demonstration of distributed real time tracking using both TV and acoustic sensors. Tracking was implemented as a geographically decentralized confederacy of autonomous cooperating nodes. Thus the feasibility of this organization has been established for a DSN system containing multiple sensor types as well as distributed nodes. GRA

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance, 39 Structural Mechanics,* and *16 Space Transportation.*

N87-27702*# Georgia Inst. of Tech., Atlanta. School of Mechanical Engineering.

DEVELOPMENT OF AN EMULATION-SIMULATION THERMAL CONTROL MODEL FOR SPACE STATION APPLICATION Semiannual Status Report

Gene T. Colwell and James G. Hartley Jul. 1987 11 p

(Grant NAG1-551)

(NASA-CR-181221; NAS 1.26:181221) Avail: NTIS HC A02/MF A01 CSCL 22B

Many features were added to the Thermal Control System (TCS) program to increase its user-friendliness. Several apparent inconsistencies were identified. In some instances, these have led to modifications to the source programs. With the summary line-sizing information, the user can more readily compare the TCS program results with other available data. Two mathematical models were completed: one deals with sizing and analysis of bus heat exchangers and the other provides a means of analyzing a variety of heat pipe radiator designs. A generic heat pipe model was added to the TCS Analysis Program. B.G.

N87-27703# Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France). Div. Systemes Balistiques et Spatiaux.

THERMAL PROTECTION SYSTEMS FOR REENTRY VEHICLES Final Report [SYSTEMES DE PROTECTION THERMIQUES POUR VEHICULES DE RENTREE]

A. Silbermann Paris, France ESA 24 Apr. 1986 97 p In

FRENCH
(Contract ESTEC-6078/84-NL-PB-(SC))
(SNIAS-NT-18037/AQES; ESA-CR(P)-2337; ETN-87-99986)
Copyright Avail: NTIS HC A05/MF A01

The heat shield system of the future Hermes European vehicle is presented. The candidate materials, test and quality control procedures, and the design and European manufacturing capacity are discussed. It is shown that the options are limited to carbon-carbon, composite ceramics, and refractory metals. It is estimated that the European industry has the realization capacity necessary for this part of the Hermes project. ESA

N87-27704*# Virginia Univ., Charlottesville. Dept. of Mechanical and Aerospace Engineering.
DIGITAL CONTROL SYSTEM FOR SPACE STRUCTURE DAMPERS Annual Report
J. K. Haviland Sep. 1985 96 p
(Grant NAG1-349)
(NASA-CR-181253; NAS 1.26:181253; UVA/528224-MAE86-105)
Avail: NTIS HC A02/MF A01 CSCL 22B

A digital controller was developed using an SKD-51 System Design Kit, which incorporates an 8031 microcontroller. The necessary interfaces were installed in the wire wrap area of the SKD-51 and a pulse width modulator was developed to drive the coil of the actuator. Also, control equations were developed, using floating-point arithmetic. The design of the digital control system is emphasized, and it is shown that, provided certain rules are followed, an adequate design can be achieved. It is recommended that the so-called w-plane design method be used, and that the time elapsed before output of the up-dated coil-force signal be kept as small as possible. However, the cycle time for the controller should be watched carefully, because very small values for this time can lead to digital noise. Author

N87-27705# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
MAXIMUM LIKELIHOOD PARAMETER IDENTIFICATION OF FLEXIBLE SPACECRAFT Ph.D. Thesis
Qi Ping Chu 1987 272 p Sponsored by the Chinese Academy of Sciences, and Technische Hogeschool, Delft, The Netherlands
(ETN-87-90235) Avail: NTIS HC A12/MF A01

The finite element method is applied to generate a linear mathematical model of a general flexible spacecraft in arbitrary orbits. Model order is reduced by a quasi-static approximation of the higher frequency characteristic modes. Stochastic models to approximate modeling errors are proposed. The models for parameter estimation are linear dynamical systems with unknown process noise. Algorithms for maximum likelihood parameter estimation which account for correlations between process and measurement noise are developed. Simulated measurements are used to verify the applicability of the maximum likelihood parameter estimation algorithms to the identification of flexible spacecraft. It is demonstrated that for the spacecraft used, all unknown parameters can be estimated from the simulated measurements simultaneously with the time histories of the system model states. ESA

N87-27706# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Space Flight Dynamics Section.
STUDY ON INVESTIGATION OF THE ATTITUDE CONTROL OF LARGE FLEXIBLE SPACECRAFT. PHASE 1, VOLUME 1: TECHNICAL REPORT Final Report
G. Heimbold, comp., Th. Lange, comp., B. Schaefer, R. Stapf, H. Roth, comp., and G. Thieme, comp. (Dornier-Werke G.m.b.H., Friedrichshafen, West Germany) Paris, France ESA Feb. 1984 220 p
(Contract ESTEC-5310/82-NL-BI)
(ESA-CR(P)-2361-Vol-1; ETN-87-90462) Avail: NTIS HC A10/MF A01

Different techniques of attitude and vibration control were applied to structural dynamic models, representative of large flexible spacecraft. The high order systems are reduced to tractable design models using different order reduction methods. A two staged controller design was applied, including sensor/actuator positioning, low authority control for structural damping augmentation, and superimposed high authority control. Fundamental problems to be studied in a laboratory experiment were derived. A test structure represented by a rectangular flexible plate suspended by wires is proposed. The test procedure envisaged includes an ideal approach with respect to the peripheral hardware, and a realistic test where specific performance limitations can be included. ESA

N87-27707# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Space Flight Dynamics Section.
STUDY ON INVESTIGATION OF THE ATTITUDE CONTROL OF LARGE FLEXIBLE SPACECRAFT. PHASE 2, VOLUME 1: EXECUTIVE SUMMARY Final Report
G. Heimbold, H. Holzach, Th. Lange, comp., B. Schaefer, R. Stapf, G. Thieme, and N. Duske (Dornier-Werke G.m.b.H., Friedrichshafen, West Germany) Paris, France ESA Mar. 1985 55 p
(Contract ESTEC-5310/82-NL-BI)
(ESA-CR(P)-2361-Vol-1; ETN-87-90463) Avail: NTIS HC A04/MF A01

The hardware, experimental and theoretical modeling of the test element, and development and implementation of the controller software for large flexible spacecraft model simulation are described. Based on a finite element method structural model, confirmed by the experimental results, different sensor and actuator positions are derived. For selected configurations, active vibration and attitude controller design is performed. The feasibility of the approaches is proved by a computer performance simulation. The implementation of control laws is realized by an array processor real time routine. The experiments to be performed are summarized. ESA

N87-27708# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
STUDY ON THE INVESTIGATION OF THE ATTITUDE CONTROL OF LARGE FLEXIBLE SPACECRAFT. PHASE 2, VOLUME 2: TECHNICAL REPORT Final Report
Paris, France ESA 1986 267 p
(Contract ESTEC-5310/82-NL-BI)
(ESA-CR(P)-2361-Vol-2; ETN-87-90464) Avail: NTIS HC A12/MF A01

The hardware, experimental and theoretical modeling of the test element, and development and implementation of the controller software for large flexible spacecraft model simulation are described. Based on a finite element method structural model, confirmed by the experimental results, different sensor and actuator positions are derived. For selected configurations, active vibration and attitude controller design is performed. The feasibility of the approaches is proved by a computer performance simulation. The implementation of control laws is realized by an array processor real time routine. The experiments to be performed are summarized. ESA

N87-27709# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Space Flight Dynamics Section.
STUDY ON INVESTIGATION OF THE ATTITUDE CONTROL OF LARGE FLEXIBLE SPACECRAFT, PHASE 3 Final Report
G. Heimbold, Th. Lange, comp., N. Duske, and G. Thieme Paris, France ESA Oct. 1986 207 p
(Contract ESTEC-5310/82-NL-BI)
(ESA-CR(P)-2361-Vol-4; ETN-87-90465) Avail: NTIS HC A10/MF A01

A large flexible spacecraft (LFS) was simulated by a plate suspended from wires. Results revealed constraints, which were not predicted, so the controller was redesigned, to give reduced gain configurations, which the laboratory experience showed feasible. The first test results exhibit considerable discrepancies with respect to the theoretical predictions. A laboratory reference model was developed for theoretical performance prediction. Applying this to the tests using the updated controller design,

satisfactory agreement with the test results is achieved. The modeling uncertainty has severe consequences with respect to LFS controller design, where usually the aspect is often considered not to play such an important role. It is concluded that the controller design approaches must be checked and possibly developed to end up at feasible designs for space applications. ESA

N87-27710*# Communications Satellite Corp., Clarksburg, Md.
ON-BOARD PROCESSING SATELLITE NETWORK ARCHITECTURE AND CONTROL STUDY Final Report
S. Joseph Campanella, B. Pontano, and H. Chalmers Jun. 1987 18 p
(Contract NAS3-24886)
(NASA-CR-180816; NAS 1.26:180816) Avail: NTIS HC A02/MF A01 CSCL 22B

For satellites to remain a vital part of future national and international communications, system concepts that use their inherent advantages to the fullest must be created. Network architectures that take maximum advantage of satellites equipped with onboard processing are explored. Satellite generations must accommodate various services for which satellites constitute the preferred vehicle of delivery. Such services tend to be those that are widely dispersed and present thin to medium loads to the system. Typical systems considered are thin and medium route telephony, maritime, land and aeronautical radio, VSAT data, low bit rate video teleconferencing, and high bit rate broadcast of high definition video. Delivery of services by TDMA and FDMA multiplexing techniques and combinations of the two for individual and mixed service types are studied. The possibilities offered by onboard circuit switched and packet switched architectures are examined and the results strongly support a preference for the latter. A detailed design architecture encompassing the onboard packet switch and its control, the related demand assigned TDMA burst structures, and destination packet protocols for routing traffic are presented. Fundamental onboard hardware requirements comprising speed, memory size, chip count, and power are estimated. The study concludes with identification of key enabling technologies and identifies a plan to develop a POC model.
Author

N87-27711*# Communications Satellite Corp., Clarksburg, Md.
ON-BOARD PROCESSING SATELLITE NETWORK ARCHITECTURE AND CONTROL STUDY Final Report
S. Joseph Campanella, Benjamin A. Pontano, and Harvey Chalmers Jun. 1987 207 p
(Contract NAS3-24886)
(NASA-CR-180817; NAS 1.26:180817) Avail: NTIS HC A10/MF A01 CSCL 22B

The market for telecommunications services needs to be segmented into user classes having similar transmission requirements and hence similar network architectures. Use of the following transmission architecture was considered: satellite switched TDMA; TDMA up, TDM down; scanning (hopping) beam TDMA; FDMA up, TDM down; satellite switched MF/TDMA; and switching Hub earth stations with double hop transmission. A candidate network architecture will be selected that: comprises multiple access subnetworks optimized for each user; interconnects the subnetworks by means of a baseband processor; and optimizes the marriage of interconnection and access techniques. An overall network control architecture will be provided that will serve the needs of the baseband and satellite switched RF interconnected subnetworks. The results of the studies shall be used to identify elements of network architecture and control that require the greatest degree of technology development to realize an operational system. This will be specified in terms of: requirements of the enabling technology; difference from the current available technology; and estimate of the development requirements needed to achieve an operational system. The results obtained for each of these tasks are presented. B.G.

N87-27712*# Howard Univ., Washington, D. C. Dept. of Mechanical Engineering.
THE DYNAMICS AND CONTROL OF LARGE FLEXIBLE SPACE STRUCTURES X, PART 1 Final Report
Peter M. Bainum, A. S. S. R. Reddy, Feiyue Li, and Cheick M. Diarra Aug. 1987 72 p
(Grant NsG-1414)
(NASA-CR-181287; NAS 1.26:181287) Avail: NTIS HC A04/MF A01 CSCL 22B

The effect of delay in the control system input on the stability of a continuously acting controller which is designed without considering the delay is studied. The stability analysis of a second order plant is studied analytically and verified numerically. For this example it is found that the system becomes unstable for a delay which is equivalent to only 16 percent of its natural period of motion. It is also observed that even a small amount of natural damping in the system can increase the amount of delay that can be tolerated before the onset of instability. The delay problem is formulated in the discrete time domain and an analysis procedure suggested. The maximum principle from optimal control theory is applied to minimize the time required for the slewing of a general rigid spacecraft. The slewing motion need not be restricted to a single axis maneuver. The minimum slewing time is calculated based on a quasi-linearization algorithm for the resulting two point boundary value problem. Numerical examples based on the rigidized in-orbit model of the SCOLE also include the more general reflector line-of-sight slewing maneuvers. Author

N87-27713* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PRELOADED SPACE STRUCTURAL COUPLING JOINTS Patent
Marvin D. Rhodes, inventor (to NASA) 4 Aug. 1987 10 p
Filed 30 Jul. 1986 Supersedes N86-21630 (24 - 23, p 3565
(NASA-Case-LAR-13489-1; US-Patent-4,684,156;
US-Patent-Appl-SN-890445; US-Patent-Class-285-27;
US-Patent-Class-285-31; US-Patent-Class-285-86;
US-Patent-Class-285-373; US-Patent-Class-285-421;
US-Patent-Class-403-341) Avail: US Patent and Trademark Office CSCL 22B

A coupling device for tubular members of large truss structures with a locking collar being the only moving part is described. Each tubular member is constructed with an end bell section that has a belled flange with a mating face, and a necked area which is smaller in diameter than the tubular members to be joined. A split ring is affixed to each tubular member and is constructed so that when two tubular members are laterally moved into axial alignment and the collar is rotated over it, the split ring loads the joint with axial forces by pressing the belled flange mating surfaces together, and a preloading force is provided by the collar mating with a taper on the outside of the split rings. All free play is thereby removed by preloaded force. A major object is to provide an ability to remove and replace individual tubular members without disturbing other structural parts of a truss structure. An additional anticipated use of this joint is to couple high pressure fluid lines.
Official Gazette of the U.S. Patent and Trademark Office

N87-27714# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
FUNCTIONAL MODEL FOR A SYSTEM OF COLD GAS JETS FOR ATTITUDE CONTROL SATELLITES M.S. Thesis [MODELAGEM DO FUNCIONAMENTO DE UM SISTEMA DE JATOS DE GAS FRIO PARA CONTROLE DE ATITUDE DE SATELTIES]
Ismael Emilio deOliveiro, Jr. May 1987 167 p In PORTUGUESE; ENGLISH summary
(INPE-4163-RPE/541) Avail: NTIS HC A08/MF A01

A model for a cold jet system to provide attitude control for satellites is presented. The model includes on and off transient periods, in which the control valve exerts the major influence. Consequently, this valve is studied in detail, with an electromagnetic analysis of its actuation. From the model is derived the graphics of the principle parameters related to the control valve, and of

the thrust produced by one of the system's micromotors. Then, a simulation is made of the desaturation maneuver of the reaction wheel and of the attitude changing maneuver. Author

N87-27688# Joint Publications Research Service, Arlington, Va.
PRAVDA COMMENTARY, PHOTOS OF MIR ORBITAL STATION
A. Pokrovskiy *In its* USSR Report: Space 21 Apr. 1986 p 3-8 Transl. into ENGLISH from Pravda (USSR), 21 Feb. 1986 p 1; 3 (For primary document see N87-27687 22-12)
Avail: NTIS HC A07/MF A01

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

N87-27715# Liege Univ. (Belgium). Inst. d'Astrophysique.
TEST OF IN-FLIGHT ALIGNMENT MEASUREMENT Final Report
D. Malaise and N. Ninane Paris, France ESA 25 Sep. 1986 48 p
(Contract ESA-5576/83-NL-AN)
(ESA-CR(P)-2349; ETN-87-99996) Avail: NTIS HC A03/MF A01

An experimental set up to assess an optical system for measuring angles around the line of sight used for alignment on spacecraft was developed. The basic feature of the system, a twist polarimeter, is light modulation produced by a Pockels cell. The Pockels cell is disappointing. If the axis of the crystal is not maintained in the direction of light propagation, the modulation varies sharply, resulting in an instability incompatible with a simple laboratory demonstration. A Faraday cell for use during tests of HIPPARCOS was developed and vacuum certified. ESA

N87-27694# Joint Publications Research Service, Arlington, Va.
COMPUTER SYSTEM FOR CONTROLLING, ACQUIRING, RECEIVING AND TRANSMITTING SCIENTIFIC INFORMATION ON VEGA-1 AND VEGA-2 SPACECRAFT
Vyacheslav Mikhaylov Balebanov, V. D. Glazkov, V. M. Linkin, and B. A. Novikov *In its* USSR Report: Space 21 Apr. 1986 p 70-87 Transl. into ENGLISH from Novoye v Zhizni, Nauke, Tekhnike: Seriya Kosmonavtike, Astronomiya (Moscow, USSR), no. 10, Oct. 1985 p 26-47 (For primary document see N87-27687 22-12)
Avail: NTIS HC A07/MF A01

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxilliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 44 Energy Production and Conversion,* and *15 Launch Vehicles and Space Vehicles.*

N87-27716# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
SOLID FUEL COMBUSTION CHAMBER Progress Report no. 4, Jul.-Dec. 1984
H. Wittenberg, P. A. O. G. Korting, J. B. Vos, J. P. M. Versmissen, T. Wijchers, and J. H. vanDijk Jan. 1985 25 p Sponsored by the Netherlands Foundation for Technical Research, Project Office for Energy Research, Technische Hogeschool, Delft, Netherlands and Prins Maurits Lab. TNO Prepared in cooperation with Prins Maurits Lab. TNO, Rijswijk
(DLR-Proj-14.0120/PBE-90743.140)
(VTH-LR-448; PML-1982-C3; B8707430; ETN-87-90197) Avail: NTIS HC A02/MF A01

Progress in developing a combustion chamber to study flow and combustion processes in solid fuel grains is described. ESA

N87-27717# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
HYBRID ROCKET MOTOR EXPERIMENTS
Y. M. Timnat and P. A. O. G. Korting Feb. 1985 71 p Sponsored by the Netherlands Foundation for Technical Research, the Project Office for Energy Research, Technische Hogeschool, Delft, The Netherlands, and the Prins Maurits Lab. TNO Prepared in cooperation with Prins Maurits Lab. TNO
(VTH-LR-452; PML-1984-C04; SFCC-23; B8707434; ETN-87-90201) Avail: NTIS HC A04/MF A01

Polyethylene and plexiglass were burnt as fuels with oxygen or mixtures of oxygen and nitrogen as oxidizer in a hybrid rocket motor, between 0.3 and 2.5 MPa. The regression rate of polyethylene and plexiglas is affected by the mass flux, the geometry of the fuel and the chamber, the pressure level, and the composition of the oxidizer. The regression rate lies between 0.18 and 0.99 mm/sec. A rearward facing step increases the mean regression and changes the profile of the burned fuel grain. The effect of pressure on the regression appears to be stronger at low pressures. For polyethylene no pressure effect is noticeable above 1 MPa while for plexiglas this tends to disappear at 2 MPa. The characteristic velocity depends on the mixture ratio and the residence time of the combustion gases. ESA

N87-27718# Brookhaven National Lab., Upton, N. Y.
ULTRA-HIGH TEMPERATURE DIRECT PROPULSION
K. J. Araj, G. Slovik, J. R. Powell, and H. Ludewig Jan. 1987 13 p Presented at the 4th Symposium on Space Nuclear Power Systems, Albuquerque, N. Mex., 12 Jan. 1987
(Contract DE-AC02-76CH-00016)
(DE87-010066; BNL-39696; CONF-870102-24) Avail: NTIS HC A02/MF A01

Potential advantages of ultra-high exhaust temperature (3000 K to 4000 K) direct propulsion nuclear rockets are explored. Modifications to the Particle Bed Reactor (PBR) to achieve these temperatures are described. Benefits of ultra-high temperature propulsion are discussed for two missions - orbit transfer (V = 5546 m/s) and interplanetary exploration (V = 20000 m/s). For such missions ultra-high temperatures appear to be worth the additional complexity. Thrust levels are reduced substantially for a given power level, due to the higher enthalpy caused by partial disassociation of the hydrogen propellant. Though technically challenging, it appears potentially feasible to achieve such ultra high temperatures using the PBR. DOE

N87-27719# Illinois Univ., Urbana. Dept. of Mechanical and Industrial Engineering.
LASER-SUSTAINED PLASMAS FOR APPLICATION TO ROCKET PROPULSION Final Report, 1 Feb. 1983 - 15 Mar. 1987
J. Mazumder, H. Krier, B. K. McMillin, D. K. Zerkle, and X. Chen 1 Apr. 1987 148 p
(Grant AF-AFOSR-0041-83)
(AD-A182348; UILU-ENG-87-4002; AFOSR-87-0823TR) Avail: NTIS HC A07/MF A01 CSCL 21H

Laser propulsion is the production of high specific impulse rocket thrust using a high-energy laser as a remote power source. Specific impulses in excess of 1000 sec are achievable because propellant temperatures are very high and low molecular weight gases can be used. This report highlights the research status of the fourth year of Air Force Office of Scientific Research (AFOSR) sponsored work for converting the laser energy, and reports the results of ongoing experiments using laser-sustained plasma as the conversion mechanism. Major new findings from our spectroscopic techniques to diagnose the laser-sustained plasma are also reported. The results indicate that it is possible to absorb almost all of the laser energy in the plasma, but that more effective ways are required to assure that the thermal energy of the gases flowing around and through the plasma(s) can approach efficiencies exceeding 50 percent. Fundamental research in the area of extremely high temperature gas mixing by forced convection is

called for. Techniques by which the gas can reabsorb the radiation energy from the laser-sustained plasma will have to be developed. GRA

N87-27720# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN EXPERIMENTAL STUDY OF A ROCKET-RAMJET NOZZLE CLUSTER M.S. Thesis
Jody A. Maxwell Mar. 1987 154 p
(AD-A182604; AFIT/GAE/AA/87M-3) Avail: NTIS HC A08/MF A01 CSCL 20D

This research involved the investigation of pressure and flow fields in the base region of a clustered rocket-ramjet nozzle. Nozzle exit conditions simulating up to 75,000 feet and chamber-to-ambient pressure ratios of up to 200 were used. The clustered nozzles investigated simulated the flow for a pair of two-dimensional supersonic convergent-divergent rocket nozzles and a centered two-dimensional supersonic convergent-divergent ramjet nozzle. Six nozzle sets of various area ratios were examined. Schlieren photographs were used to assist in the flow field analysis. The results of this study indicate that the pressures in the nozzle base and the flow pattern downstream from the clustered nozzle exit are dependent on the ramjet nozzle inlet pressure. Additionally, a non-symmetrical oblique shock pattern formed as the clustered nozzle flow transitioned from the underexpanded regime to the overexpanded regime. It appears that the non-symmetrical shock pattern is a function of the chamber-to-ambient pressure ratio for the rocket nozzle and the area ratio for the rocket nozzle. GRA

N87-27721# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THRUST MODULATION OF A SOLID PROPELLANT ROCKET ENGINE M.S. Thesis - Aug. 1986 [MODULACAO DO EMPUXO DE MOTOR FOGUETE A PROPELENTE SOLIDO]
Fernando FachiniFilho Apr. 1987 85 p In PORTUGUESE; ENGLISH summary
(INPE-4158-TDL/270) Avail: NTIS HC A05/MF A01

Described is a method of thrust modulation of a solid propellant rocket motor. The method involves the injection of monatomic gases, helium and organ, into the combustion chamber, which modifies the flame structure over the grain surface and, consequently, changes the burning rate, thus modifying the thrust. Author

N87-27722# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
CATALYTIC DECOMPOSITION OF HYDRAZINE FOR MICROPROPULSION [DECOMPOSICAO CATALITICA DE HIDRAZINA PARA MICROPROPULSAO]
Waltero Gill and Francisco Carlos EliziodePaula May 1987 21 p In PORTUGUESE; ENGLISH summary Presented at the 4th Brazilian Congress of Energy
(INPE-4179-NTE/269) Avail: NTIS HC A02/MF A01

A study of hydrazine decomposition in a combustion chamber operating at different stagnation temperatures shows that the temperature can be controlled by the stagnation pressure. The performance of this system as a thruster is little affected by operation at low pressure, indicating the viability of such thrusters. Author

N87-27723*# National Aeronautics and Space Administration, Washington, D.C.
QUESTIONS OF TESTING RATE AND FLEXIBILITY OF ROCKET TEST BENCHES, DISCUSSED ON THE BASIS OF THE TEST BENCHES OF NITROCHEMIE GMBH IN ASCHAU
Legrand Aug. 1987 6 p Transl. into ENGLISH of Fragen der Versuchskadenz und Flexibilitaet von Rakentenpruefstanden, Diskutiert auf der Grundlage der Pruefstaende der Nitrochemie GmbH in Aschau presented at the 7th WLGR Meeting on Rocket Technology, 1968 p 7-10 Meeting held Dec. 1968 Original language document was announced as N70-29152 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TT-20085; NAS 1.77:20085) Avail: NTIS HC A02/MF A01 CSCL 21H

The rocket test benches are used to study burnup behavior by various methods. In the first ten months of 1966, 1578 shots were performed to test propellants, and 920 to test 14 thrust and pressure measurement projects. Author

23 CHEMISTRY AND MATERIALS (GENERAL)

N87-27724# Centre d'Etudes et de Recherches, Toulouse (France). Dept. d'Etudes et de Recherches en Technologies Spatiales.
IMPROVING CONTAMINATION PLUS IRRADIATION TESTS. COMPLEMENT TO PRESTUDY NUMBER 1. VOLUME 1: ACCELERATED ULTRAVIOLET RADIATION. VOLUME 1: TESTS AND CONCLUSIONS Final Report [AMELIORATION DES ESSAIS CONTAMINATION PLUS IRRADIATION. COMPLEMENT A LA PREETUDE NO. 1. TOME 1: ESSAIS ET CONCLUSIONS]
Ph. Millan, A. Paillous, C. Sable, and J. Siffre Paris, France ESA Jan. 1986 47 p In FRENCH
(Contract ESTEC-5781/83-NL-AB)
(CERT-4193-Vol-1; ESA-CR(P)-2328-Vol-1; ETN-87-99877) Avail: NTIS HC A03/MF A01

Tests on spacecraft materials were carried out using ultraviolet irradiation either with 45 deg or normal incidence with Sun equivalent intensity or 4 times the equivalent with normal incidence. The duration of irradiation was up to 800 hr cumulative solar intensity. The comparison of results with those of previous tests shows that materials damage prediction in space can be deduced from data with a certainty of 0.025 for reflecting white paints and fabrics and up to 0.005 for metallized FE polymers. Results can show however large deviations which are difficult to explain. These abnormal results are discussed. ESA

N87-27725# Centre d'Etudes et de Recherches, Toulouse (France). Dept. d'Etudes et de Recherches en Technologies Spatiales.
IMPROVING CONTAMINATION PLUS IRRADIATION TESTS. COMPLEMENT TO PRESTUDY NUMBER 1. EFFECTS OF AN INCREASE IN THE INTENSITY OF ULTRAVIOLET RADIATION. VOLUME 2: DETAILED RESULTS Final Report [AMELIORATION DES ESSAIS CONTAMINATION PLUS IRRADIATION. COMPLEMENT A LA PREETUDE NO. 1. EFFET D'UNE AUGMENTATION DE L'INTENSITE DES IRRADIATIONS ULTRAVIOLETTES. TOME 2: RESULTATS DETAILLES]
Ph. Millan, A. Paillous, C. Sable, and J. Siffre Paris, France ESA Jan. 1986 99 p In FRENCH
(Contract ESTEC-5781/83-NL-AB)
(CERT-4193-Vol-2; ESA-CR(P)-2328-Vol-2; ETN-87-99878) Avail: NTIS HC A05/MF A01

Tests on spacecraft materials were carried out using ultraviolet irradiation either with 45 deg or normal incidence with Sun equivalent intensity of 4 times the equivalent with normal incidence. The duration of irradiation was up to 800 hr cumulative solar intensity. The comparison of results with those of previous tests shows that materials damage prediction in space can be deduced from data with a certainty of 0.025 for reflecting white paints and fabrics and up to 0.005 for metallized FE polymers. Results can show however large deviations which are difficult to explain. These abnormal results are discussed. ESA

N87-27726# California Univ., Berkeley. Lawrence Berkeley Lab.
ENTHUSIASMS AND REALITIES IN ADVANCED MATERIALS
J. J. Gilman Apr. 1987 18 p Presented at the T. A. Read Memorial Lecture, Urbana, Ill., 15 Apr. 1987
(Contract DE-AC03-76SF-00098)
(DE87-010976; LBL-23442; CONF-8704157-1) Avail: NTIS HC A02/MF A01

This paper offers general comments on the past, present, and future of materials technology. The process by which a substance becomes an engineering material is lengthy. The following functional areas are likely to grow most in the foreseeable future: photonics, robotics, prosthetics, astronautics, and nanoelectronics. The trend in advanced materials is toward integration. DOE

N87-27727# Groningen Rijksuniversiteit (Netherlands). Materials Science Center.
[ACTIVITIES REPORT OF THE MATERIALS SCIENCE CENTER] Annual Report, 1985
May 1986 144 p
(ETN-87-90232) Avail: NTIS HC A07/MF A01

Research in particle acceleration; inorganic chemistry; chemical physics; physical chemistry; and polymer chemistry is summarized. ESA

24 COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.
For ceramic materials see *27 Nonmetallic Materials.*

N87-27728# United States Composites Corp., Troy, N.Y.
COMPUTER CONTROLLED RESIN IMPREGNATION FOR COMPOSITE BRAIDING Final Report, Sep. 1985 - Dec. 1986
August H. Kruesi and Gregory H. Hasko Apr. 1987 75 p
(Contract DAAG46-85-C-0059; DA Proj. 1L6-65502-MM-40)
(AD-A181401; MTL-TR-87-23) Avail: NTIS HC A04/MF A01
CSCL 11D

Textile processes such as braiding may significantly reduce the cost of advanced composites. Braiding can be readily automated and offers high fiber deposition rates and geometric versatility in wetting fibers moving in a complex path. A novel resin impregnation system has been developed to adapt braiding to automated production of advance composites. A tubular braider has been equipped with a computer numerical control system. Two axes are used to drive pumps which feed resin and catalyst to the resin impregnation ring. The mix ratio and resin volume fraction can be coordinated in software with braider and mandrel speeds to fabricate parts which have complex features. Test specimens have been fabricated with glass, Kevlar, and carbon fibers. Fiber wetting and void content were evaluated from microphotographs of parts cured on a mandrel without compaction. Applications for the process include space station tubes, rocket motor cases, launch tubes, gun barrel reinforcement, rotor blades, stiffeners, drill risers, and similar structural components. GRA

N87-27729# European Space Agency, Paris (France).
FRETTING FATIGUE OF CARBON FIBER REINFORCED PLASTIC LAMINATES
Karl Schulte, Stefan Kutter, and Klaus Friedrich Jan. 1987 142 p
Transl. into ENGLISH of Reib-Ermuedung von Kohlenstoffaser-verstaerkten Laminaten (Cologne, West Germany, DFVLR), Apr. 1986 Original language document was announced as N87-11855
(ESA-TT-1013; DFVLR-FB-86-18; ETN-87-90011) Avail: NTIS HC A07/MF A01; original German version available from DFVLR, Cologne, West Germany DM 59

The fretting fatigue properties of two carbon fiber reinforced plastic laminates were compared with plain fatigue tests. Nine fretting variants were obtained by varying 3 different pressures of fretting pads and pad materials. Apart from the strongly different behavior of both laminates, it is shown that there is an essential influence of fretting on the number of cycles until failure. A reduction of the number of fatigue cycles due to fretting up to three orders of magnitude is observed. ESA

N87-27730# Engineering System International, Rungis (France).
RESEARCH ON THE COMPRESSION BEHAVIOR OF THIN PLATES OF COMPOSITE MATERIALS Final Report [RECHERCHE SUR LE FLAMBAGE DE PLAQUES MINCES EN MATERIAUX COMPOSITES]
P. Dowlatyari and E. Haug Mar. 1986 91 p In FRENCH
Sponsored by Direction des Recherches Etudes et Techniques
(ED/84-450/GCM; ETN-87-90128) Avail: NTIS HC A05/MF A01

A numerical analysis of the breaking behavior of thin plates of carbon fiber-epoxy composites under compression or flexion loads is presented. The results are compared with laboratory test data. The separate models concerning the mechanisms contributing to composite failure are described. The final integrated model and computer program are discussed. It is shown that the numerical simulation is successful. ESA

N87-27731# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
PINNED CONNECTIONS IN COMPOSITE MATERIALS: THEORY AND EXPERIMENT
Th. deJong and E. C. Klang Jan. 1985 54 p
(VTH-LR-445; B8707427; ETN-87-90194) Avail: NTIS HC A04/MF A01

Stresses for a joint in an orthotropic or isotropic plate with a row of pin-loaded holes and for a finite-width joint with one connector were calculated. Friction and clearance at the interface between pin and plate material, and pin-flexibility were calculated. Stress concentrations for CFRP laminates and for aluminum 7075-T6 are presented. Hole spacing, finite-width, and clearance have significant influence on the stress distribution. The elastic response of finite-width composite specimens with one connector was measured. This response can be predicted with the elasticity solution. Failure mechanisms and damage accumulation were studied using X-ray and acoustic emission techniques. Minimal damage occurs until 85% of the maximum load. ESA

N87-27732# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
INVESTIGATION ON FRACTURE OF FIBER/ADHESIVE BOND LINES
M. L. C. E. Verbruggen Mar. 1985 92 p Sponsored by the Netherlands Foundation for Technical Research
(VTH-LR-459; B8707437; ETN-87-90204) Avail: NTIS HC A05/MF A01

Delamination in the bond line as affected by unidirectional fibers in a width tapered double cantilever beam (WTDCB) specimen and a thick adherend (TA) specimen was studied. In the WTDCB-specimen delamination occurs under mode 1 loading (tension) and in the TA-specimen it occurs under mode 2 loading (shear). An evaluation of the experimentally obtained results as a function of the fracture toughness behavior of composite materials shows that WTDCB and TA can be used to examine fracture toughness although the mutual relation is not always self-evident. ESA

N87-27733# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
MOISTURE ABSORPTION OF ARALL
M. L. C. E. Verbruggen May 1985 79 p Sponsored by the Netherlands Foundation for Technical Research
(VTH-LR-474; B8707448; ETN-87-90214) Avail: NTIS HC A05/MF A01

The moisture absorption of ARALL is compared to that of aramid and carbon fiber composites. The influence of diffusion barriers on the diffusion process is examined. The absorption rate of ARALL strongly depends on the environmental temperature while the maximum moisture content is mainly a function of the environmental relative humidity. The diffusion coefficients of ARALL for different temperature and relative humidity levels are comparable with composites. For ARALL, the diffusion coefficients of the aramid fibers themselves (in longitudinal direction) is 10 times higher than the diffusion coefficient of the surrounding matrix. The favorable

absorption behavior of ARALL compared to composites is due to the diffusion barrier function of the outer aluminum sheets. For ARALL, the presence of moisture is limited to the edges of the specimens. Perpendicular to the fiber direction, the positioning and radial fiber diffusion coefficient of the aramid fibers highly influences the moisture pick-up although the absorption itself is mainly due to the matrix. ESA

N87-27734*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
OPTIMAL CURE CYCLE DESIGN FOR AUTOCLAVE PROCESSING OF THICK COMPOSITES LAMINATES: A FEASIBILITY STUDY Progress Report, 15 Jan. - 15 Oct. 1985
Jean W. Hou Nov. 1985 42 p
(Grant NAG1-561)
(NASA-CR-181261; NAS 1.26:181261) Avail: NTIS HC A03/MF A01 CSCL 11D

The thermal analysis and the calculation of thermal sensitivity of a cure cycle in autoclave processing of thick composite laminates were studied. A finite element program for the thermal analysis and design derivatives calculation for temperature distribution and the degree of cure was developed and verified. It was found that the direct differentiation was the best approach for the thermal design sensitivity analysis. In addition, the approach of the direct differentiation provided time histories of design derivatives which are of great value to the cure cycle designers. The approach of direct differentiation is to be used for further study, i.e., the optimal cycle design. Author

N87-27735# Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Composite Materials and Structures.
MECHANICAL AND THERMAL CHARACTERIZATION OF UNIDIRECTIONAL ARAMID/EPOXY
M. J. Pindera, Z. Gurdal, J. S. Hidde, and C. T. Herakovich Feb. 1987 245 p Sponsored by Aluminum Co. of America, Alcoa Center, Pa. and Center for Innovative Technology, Herndon, Va.
(PB87-185120; VPI-E-86-29; CCMS-86/08) Avail: NTIS HC A11/MF A01 CSCL 11D

The results of an extensive experimental investigation of the mechanical and thermal response of an aramid/epoxy unidirectional composite are presented. The three test methods used are the off-axis tension test, the losipescu shear test, and the off-axis compression test. All tests were carried out at room temperature under monotonic and quasi-cyclic loading conditions. Four different off-axis orientations were employed for the off-axis tensions and compression tests to determine the initial elastic response and subsequent nonlinear response. The experimental tensile moduli were subsequently compared to the predictions of transformation theory; compressive moduli were compared to finite element analysis. Three different losipescu specimens were employed to determine the shear response; specimens with fibers parallel and perpendicular to the longitudinal axis lying in the plane of the specimen and specimens with fibers normal to the plane of the specimen. Thermal expansion coefficients were obtained in the temperature range of -50 to +200 degrees F using bonded strain-gage techniques. The results are summarized in tables and stress-strain diagrams. GRA

N87-27736# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
MODERN COMPOSITES FOR PRIMARY AIRCRAFT STRUCTURES
G. J. Spies Nov. 1985 12 p
(VTH-LR-480; B8707453; ETN-87-90219) Avail: NTIS HC A02/MF A01

Properties of composite laminates are mentioned, such as the elastic behavior, and the strength and fatigue characteristics. Composite wing sections are described. ESA

N87-27737# Army Armament Research and Development Command, Watervliet, N. Y. Weapons Lab.
COMMENT ON PAPER BY YAU AND CHOU TITLED NOTCHED STRENGTH OF WOVEN FABRIC COMPOSITES WITH MOLDED-IN HOLES Final Report
J. H. Underwood Dec. 1986 11 p
(AD-A181909; ARCCB-MR-86040) Avail: NTIS HC A02/MF A01 CSCL 11D

A comment is offered on the Yau and Chou paper, presented at the Eighth ASTM Conference on Composite Materials: Testing and Design which discussed the failure strength of fabric composite plates with holes. Classical mechanics is used to describe the change in failure strength with hole size. GRA

N87-27738# Defence Research Establishment Atlantic, Dartmouth (Nova Scotia).
DEVELOPMENT OF A SMALL SCALE TEST APPARATUS FOR THE EVALUATION OF THERMAL BARRIER MATERIALS
J. A. Hiltz and D. E. Veinot Apr. 1987 31 p
(AD-A181980; DREA-TC-87/307) Avail: NTIS HC A03/MF A01 CSCL 11B

A small scale test apparatus has been constructed and used to evaluate the relative ability of four thermal barrier materials to protect aluminum from heat damage. The apparatus used 30 x 30 cm (1 ft x 1 ft) 0.64 cm (0.25 in) aluminum panels. Several configurations of the glass and ceramic fiber cloth barrier materials (Startex 6N, Startex 4N, SilTemp, and Claretex 1925 B567) were tested to determine the degree of protection provided by the thermal barrier materials. The results obtained with the small scale apparatus have been correlated with those obtained with a modified ASTM E119 apparatus at the Fire Research Section of the National Research Council of Canada. Although the results from the small scale tests do not compare with those from the ASTM E119 test in an absolute sense, they give the same relative ranking of the ability of the barrier materials to protect aluminum from heat damage. This suggests that inexpensive small scale testing can be used to screen and rank the ability of different materials and combinations of materials to protect an aluminum substrate from heat damage. GRA

N87-27739# Naval Academy, Annapolis, Md.
FAILURE MODES IN COMPOSITE MATERIALS Final Report, 1986 - 1987
David A. Robinson 19 May 1987 58 p
(AD-A182527; USNA-TSPR-148) Avail: NTIS HC A04/MF A01 CSCL 11D

Mechanical stiffness is an important qualitative and quantitative measure of structural integrity. When a material is repeatedly stressed, some type of internal damage is known to occur which changes the mechanical property of the matter. Although studied in metals, it is not well understood in composites; composites tend to fail instantly with no apparent mechanical warning. If, as is true in the case of graphite and epoxy, the fibers conduct electricity and the resin does not, then it seems likely that increases in the electrical resistance in the direction of the fibers will indicate the presence of broken fibers and thus be a measure of fatigue damage. Even if resin damage is assumed to play a role in fatigue failure, the breaking of the graphite fibers which do carry the load is an essential step in the reduction of the ultimate strength of the material. This assumption was proven in that electrical resistance was considerably greater than the percentage change in the mechanical stiffness of the material. Consequently, electrical resistance measurements prove to be a sensitive and practical method for detecting internal damage in composite materials made up of conducting fibers in a nonconducting matrix. GRA

N87-27740# Army Armament Research and Development Command, Watervliet, N. Y. Weapons Lab.
TEST METHODS FOR MATERIAL CHARACTERIZATION OF COMPOSITE CYLINDERS Final Technical Report
Y. F. Cheng Jun. 1987 14 p
(AD-A182534; ARCCB-TR-87014) Avail: NTIS HC A02/MF A01 CSCL 11D

A study has been conducted of test methods for material characterization of composite cylinders. The purpose was to obtain constants in the stiffness matrix necessary in the design process. Test methods for determining engineering constants (Young's moduli, Poisson's ratios, and shear moduli) for composite cylinders with fibers in the axial and circumferential directions have been found. Constants in the compliance matrix can then be calculated by means of the well-known equations relating compliance matrix to engineering constants. For composite cylinders with other fiber directions, engineering constants may be obtained by the rotation of coordinate axes and rule of mixture. GRA

N87-27741# Army Armament Research and Development Command, Watervliet, N. Y. Weapons Lab.
SOME RESULTS ON ORTHOTROPIC HIGH PRESSURE CYLINDERS Final Technical Report
G. P. OHara Jun. 1987 32 p
(AD-A182535; ARCCB-TR-87015) Avail: NTIS HC A03/MF A01 CSCL 11D

With the current emphasis on composite materials, it has become necessary to use the thick wall cylinder equations for cylindrically orthotropic materials. This report is a preliminary investigation of these equations. The most important result is that many of the old ideas of high pressure cylinders will have to be changed. When the cylinder is very thin (wall ratio near 1.0), the simple thin-wall equations are adequate. However, as thickness increases, stress variation through the wall becomes large and the full thick-wall solution is necessary. In orthotropic (composite) cylinders this transition happens at a lower wall ratio. Furthermore, the maximum useful wall ratio may become smaller for a composite cylinder. GRA

N87-27742*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LIGHTWEIGHT PISTON Patent
Allan H. Taylor, inventor (to NASA) 4 Aug. 1987 8 p Filed 2 May 1985 Supersedes N85-28975 (23 - 18, p 3068)
(NASA-Case-LAR-13150-1; US-Patent-4,683,809; US-Patent-Appl-SN-729767; US-Patent-Class-92-208; US-Patent-Class-29-156.5-R) Avail: US Patent and Trademark Office CSCL 11D

A lightweight piston composed of carbon-carbon composites is presented. The use of carbon-carbon composites over conventional materials, such as aluminum, reduces piston weight and improves thermal efficiency of the internal combustion reciprocation engine. Due to the negligible coefficient of thermal expansion and unique strength at elevated temperatures of carbon-carbon, the piston-to-cylinder wall clearance is so small as to eliminate the necessity for piston rings. Use of the carbon-carbon composite has the effect of reducing the weight of other reciprocating engine components allowing the piston to run at higher speeds and improving specific engine performance.
Official Gazette of the U.S. Patent and Trademark Office

N87-27743*# National Aeronautics and Space Administration, Washington, D.C.
SCALAR EFFECT OF FIBER STRENGTH AND PROPERTIES OF UNIDIRECTIONAL COMPOSITES BASED ON THEM Abstract Only
Yu. G. Korabelnikov, V. P. Tamuzh, O. F. Siluyanov, V. M. Bondarenko, and M. T. Azarova Aug. 1987 14 p Transl. into ENGLISH from Mekhanika Kompozitnykh Materialov (USSR), no. 2, Mar. - Apr. 1984 p 195-200 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TT-20109; NAS 1.77:20109) Avail: NTIS HC A02/MF A01 CSCL 11D

Reinforcing fibers are subject to a scale effect related to binding length. Previous studies have ignored the importance of fiber matrix shift; the present study considers the effect of adhesion on composite material failure under stretching and offers a simplified theoretical model for determining applicable parameters. The hypothesis that strength increases with fiber separation in the composite is tested. Practice has shown that maximum theoretical strength is never reached because at low stress values, fiber breaks result in the development of major cracks. Various approaches to assessing the strength of fiber-reinforced composite materials are suggested, with emphasis on the Weibull distribution. The authors conclude that reducing fiber diameter and increasing adhesion are key factors for improving strength. A theoretical mathematical model is shown to coincide with experimental results. Author

N87-27744*# Hercules, Inc., Magna, Utah. Aerospace Div.
INTERFACIAL ADHESION OF CARBON FIBERS Final Report, Nov. 1984 - Oct. 1986
Willard D. Bascom Aug. 1987 53 p
(Contract NAS1-17918)
(NASA-CR-178306; NAS 1.26:178306) Avail: NTIS HC A04/MF A01 CSCL 11D

Relative adhesion strengths between AS4, AS1, and XAS carbon fibers and thermoplastic polymers were determined using the embedded single filament test. Polymers studied included polycarbonate, polyphenylene oxide, polyetherimide, polysulfone, polyphenylene oxide blends with polystyrene, and polycarbonate blends with a polycarbonate polysiloxane block copolymer. Fiber surface treatments and sizings improved adhesion somewhat, but adhesion remained well below levels obtained with epoxy matrices. An explanation for the differences between the Hercules and Grafil fibers was sought using X ray photon spectroscopy, wetting, scanning electron microscopy and thermal desorption analysis.
Author

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*.

N87-27745 Case Western Reserve Univ., Cleveland, Ohio.
APPLICATION OF LOW-REYNOLDS-NUMBER K TWO EQUATION MODEL TO SOLID FUEL TURBULENT BOUNDARY LAYER COMBUSTION Ph.D. Thesis
David Yu-Yung Shan 1987 117 p
Avail: Univ. Microfilms Order No. DA8710123

Turbulent combustion in a boundary layer adjacent to a pyrolyzing solid fuel surface is analyzed. For the velocity field and turbulence viscosity, the low-Reynolds-number two-equation model by Jones and Launder is adopted. The combustion model is modified from the mixing layer formulation using infinite fast chemical kinetics and beta probability density function for the mixture fraction. The flame and flow field are solved numerically by a downstream marching scheme. The flame structure predicted by this model shows that the time averaged mass fraction of fuel and oxidizer overlap substantially. A rounded temperature profile is observed with the maximum mean temperature well below the adiabatic value. In addition, a comparison of the boundary layer structure with incompressible cases is made. Dissert. Abstr.

N87-27746# Lyon-1 Univ. (France). Lab. de Physico-Chimie Minerale 2.
SYNTHESIS OF MONOMETHYLHYDRAZINE Final Report [SYNTHESE DE LA MONOMETHYLHYDRAZINE]
M. Giudice, D. Martin, and M. Th. SaugierCohen-Adad Jan. 1987 29 p In FRENCH
(Contract DRET-85/094)
(ETN-87-90129) Avail: NTIS HC A03/MF A01

Monomethylhydrazine (MMH) extraction from the synthesis solution and the realization of a 30 gr/hr pilot plant are described. The obtention of azeotropes and dry products results from quaternary system studies and relative volatility measurements. The feasibility of the procedure is demonstrated as well as the separation of volatile fractions. ESA

N87-27747# Netherlands Energy Research Foundation, Petten.
ON-LINE RADIOMETRY IN HIGH PERFORMANCE LIQUID CHROMATOGRAPHY USING A STORAGE LOOP
H. J. vanNieuwkerk Jan. 1987 144 p
(ECN-196; B8701543; ETN-87-90182) Avail: NTIS HC A07/MF A01

On-line counting in radio liquid chromatography is reviewed. Sensitivity and resolution can match that of fraction collection and separate counting, if a spacer liquid and a storage loop are used. In most other cases on-line counting is useful as a rapid first scan. The method may be given a wider scope by introducing pre or post column labeling of the analyte with a radioactive reagent. This implies the separation of the excess of reagent from the (now radiolabelled) analyte. The radionuclide involved should feature a sufficiently long half-life to allow for the use of one single batch of reagent in a series of analyses. A convenient choice could be 35S, T1/2 = 87.5 d, E Beta(-) = 1.5 MeV.
ESA

N87-27748*# Cooper Union, New York. Research Foundation.
A COMPREHENSIVE MODEL TO DETERMINE THE EFFECTS OF TEMPERATURE AND SPECIES FLUCTUATIONS ON REACTION RATES IN TURBULENT REACTING FLOWS Final Report
W. Chinitz 3 Feb. 1986 118 p
(Grant NAG1-18)
(NASA-CR-181227; NAS 1.26:181227) Avail: NTIS HC A06/MF A01 CSCL 21B

A computationally-viable model describing the interaction between fluid-mechanical turbulence and finite-rate combustion reactions, principally in high-speed flows was developed. Chemical kinetic mechanisms, complete and global, were developed describing the finite rate reaction of fuels of interest to NASA. These fuels included principally hydrogen and silane, although a limited amount of work involved hydrocarbon fuels as well. B.G.

N87-27749# Los Alamos National Lab., N. Mex.
LASER-INDUCED BREAKDOWN SPECTROSCOPY: A NEW TECHNIQUE FOR NONDESTRUCTIVE ANALYSIS OF SOLUTIONS
R. G. Gutmacher, D. A. Cremers, and J. R. Wachter 1987 4 p Presented at the 9th Annual Meeting of the European Safeguards Research and Development Association: Safeguards and Nuclear Material Management, London, England, 12 May 1987
(Contract W-7405-eng-36)
(DE87-008999; LA-UR-87-1279; CONF-870519-3) Avail: NTIS HC A02/MF A01

Laser-induced breakdown spectroscopy has been applied to the continuous determination of uranium in solutions. The technique is rapid, non-invasive, and unaffected by radioactivity. Powerful laser pulses are focused through an optical access onto the solution surface to produce a hot spark plasma. In experiments on static solutions, uranium concentrations between 0.1 and 300 g/L were determined, using a pulsed Md:YAG laser and a time-gated photodiode array. A concentration of 4.2 g/L was measured with 1.0% precision in 3 minutes. Substances that absorb at the laser wavelength, suspended materials, and variations in the acidity of the solution have little or no effect on the results. Experiments are in progress on flowing streams contained in a test loop that simulates plant operating conditions. DOE

N87-27750# Technische Hogeschool, Delft (Netherlands).
THE CALCULATION OF TURBULENT REACTING FLOWS WITH A COMBUSTION MODEL BASED ON FINITE CHEMICAL KINETICS Ph.D. Thesis
Jan Bernhard Vos 1987 198 p
(ETN-87-90233) Avail: NTIS HC A09/MF A01

Flow and combustion processes in solid fuel combustion chambers were studied using the computer codes COPPEF and KINETICS. To allow the calculation of flows with combustion using a combustion model based on finite chemical kinetics, the codes are coupled by a pseudo-time-splitting technique. To permit low inlet gas temperatures, an ignition pulse was simulated during the iteration process. Calculations describing the flow and combustion of H2-O2 mixtures and H2-air mixtures are discussed. Comparison of results obtained with the finite chemical kinetics model to results obtained with combustion models based on the diffusion flame concept shows that dissociation and the effect of turbulence on the combustion process must be taken into account for a detailed description of turbulent flows with combustion. ESA

N87-27751# Lawrence Livermore National Lab., Calif.
RESPONSE OF A PULSE COMBUSTOR TO CHANGES IN TOTAL IGNITION DELAY TIME
J. O. Keller, C. K. Westbrook, T. T. Bramlette, and J. E. Dec 31 Mar. 1987 7 p Presented at the Combustion Fundamentals and Applications: Spring Technical Meeting of the Central States Section of the Combustion Institute, Argonne, Ill., 11 May 1987
(Contract W-7405-eng-48)
(DE87-008843; UCRL-96437; CONF-870541-1) Avail: NTIS HC A02/MF A01

The response of a valved pulse combustor to changes in the relative timing between the resonant pressure wave and the energy release rate is examined. Experiments were performed in which measurements of combustion chamber pressure, operating frequency, and spatially-integrated, time-resolved ensemble-averaged (OH^*) chemiluminescence were made. The total time interval required for energy release is divided into a fluid dynamic species mixing time, a second fluid dynamic mixing time between cold reactants and hot reaction products, and a homogeneous chemical kinetic ignition delay time. Each of these time scales is varied independently, as well as the characteristic resonance time of the pulse combustor. It is shown that each time scale can be varied separately to optimize the operation of the pulse combustor. All of these system responses are interpreted in terms of Rayleigh's Criterion. In addition, theoretical models for the fluid dynamic mixing process and the chemical kinetic ignition delay are used to determine actual values for the time scales for some of these subprocesses. DOE

N87-27752# Sandia National Labs., Albuquerque, N. Mex.
FLAME ACCELERATION IN MIXTURES OF HYDROGEN AND AIR
J. C. Cummings, J. R. Torczynski, and W. B. Benedick Jun. 1987 106 p
(Contract DE-AC04-76DP-00789)
(DE87-011907; SAND-86-0173) Avail: NTIS HC A06/MF A01

Turbulence and acoustic instabilities can play important roles in the development of combustion-generated pressure for both closed and vented vessels. Given the proper conditions, it has been observed experimentally that the standard explosion venting guidelines can be rendered invalid. This report summarizes the results of a series of experiments conducted for the purpose of studying the acceleration of flames in mixtures of hydrogen and air. The acceleration of these flames caused combustion-generated pressures to significantly exceed the explosion venting guidelines. The report reviews the analysis required to predict the pressure history within closed or vented vessels due to combustion. A simple numerical model is developed and calculational results are compared to the experimental data. DOE

N87-27753# Illinois Univ., Chicago.
EXPERIMENTAL INVESTIGATION OF TURBULENT FLAMES Final Technical Report, 1 Aug. 1983 - 31 Jul. 1984
K. V. Dandekar 28 May 1987 6 p
(Grant AF-AFOSR-0274-83)
(AD-A181922; AFOSR-87-0825TR) Avail: NTIS HC A02/MF A01 CSCL 14B

The instrumentation grant was awarded to the University of Illinois for the purchase of a laser velocimeter needed for experimental investigation of turbulent reacting flows in the combustors. The requested instruments were purchased and installed. Fabrication of an experimental facility for investigating isothermal flow fields in combustors is complete. The unique capabilities of this facility and the current status of the experimental work are described. GRA

N87-27754# Israel Inst. of Metals, Haifa.
LASER AND ELECTROCHEMICAL STUDIES OF METALLIZATIONS IN ELECTRONIC DEVICES Annual Research Report No. 1, Oct. 1985 - Oct. 1986
J. Zahvi, M. Rotel, and B. Dobbs Jan. 1987 103 p
(Grant AF-AFOSR-0309-85)
(AD-A181963; EOARD-TR-87-06) Avail: NTIS HC A06/MF A01 CSCL 11F

Environmental and corrosion behavior of Pb-Sn electrodeposits was studied by electrochemical polarization techniques and scanning electron microscopy. Experiments with D.I. water containing .001 to .1 MC1(-) showed that for a given deposit, the corrosion rate increases with C1(-) concentration and decreases with deposit thickness in the 2 to 25 micro range. The mode of corrosion was associated with preferred dissolution of lead. Deposits were also irradiated with Nd-Yag pulse laser at 530mm and 2 by 10 to the 8th power -2. 10 to the 9th power watt/sq. cm power density and the treated zones were examined. GRA

N87-27755# Army Armament Research and Development Command, Dover, N. J. Armament Engineering Directorate.
HYDROGEN CARS (COHERENT ANTISTOKES RAMAN SPECTROSCOPY) SPECTRA FROM CH(4)/N(2)O AND NITRAMINE COMPOSITE FLAMES
L. E. Harris May 1987 42 p
(AD-A182113; ARAED-TR-87014) Avail: NTIS HC A03/MF A01 CSCL 20E

The hydrogen spectra from the CH(4)/N(2)O and nitramine composite flames allow use of each of the concurrent capabilities of Coherent Antistokes Raman Spectroscopy (CARS): (1) rovibrational state resolution better than a wavenumber, (2) time resolution better than 10 nrs, and (3) spatial resolution better than 100 micrometers. The rovibrational state resolution results in direct observation of previously unobserved higher J transitions in the Q branch $v = 0$ and $v = 1$ and S branch $v = 0$ transitions. These transitions are in accord with transitions calculated from ab initio results and with transitions indirectly obtained from electronic emission spectra. The ab initio results give a compact set of constants that give results within experimental accuracy of the CARS experimental results. The experimental transition energies were used to construct Boltzmann plots that allow discrimination among the various spectra used to determine temperature. CARS provides the spectral resolution and intensity to allow direct observation of previously unobserved hydrogen higher J and v rotational transitions. GRA

N87-27756# Naval Research Lab., Washington, D.C.
TIME-DEPENDENT SIMULATIONS OF LAMINAR FLAMES IN HYDROGEN-AIR MIXTURES
K. Kailasanath and E. S. Oran 17 Jun. 1987 16 p
(AD-A182127; NRL-MR-5965) Avail: NTIS HC A02/MF A01 CSCL 21B

Two fundamental problems in premixed laminar flames using a detailed, time-dependent, one-dimensional model are examined. In the first problem, the relative importance of thermal conduction, thermal diffusion, and ordinary diffusion are examined to determine the burning velocities of laminar hydrogen-air flames. Three cases were examined in detail: a fuel-lean mixture, a stoichiometric mixture, and a fuel-rich mixture. The general conclusion from this study is that both ordinary diffusion and thermal conduction are necessary to quantitatively describe flame propagation in a hydrogen-air mixture. Their relative importance, however, varies as we go from fuel-lean to fuel-rich hydrogen-air mixtures. In the second problem, the behavior of flames in fuel rich hydrogen-air mixtures near the experimentally observed flammability limit is considered. The effects of gravity, stretch and external heat losses were eliminated in the numerical simulations. The results suggest wider flammability limits than those observed experimentally under normal gravity conditions. The simulations also indicate that there may be a limit due to chemical kinetic considerations alone. GRA

N87-27757# Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering.
A STUDY OF THE USE OF Y2O3 DOPED ZrO2 MEMBRANES FOR SOLAR ELECTROTHERMAL AND SOLARTHERMAL SEPARATIONS
Donald J. Parks, Kent L. Scholl, and Edward A. Fletcher 6 Jul. 1987 51 p
(Contract N00014-82-K-0523)
(AD-A182306; TR-8) Avail: NTIS HC A04/MF A01 CSCL 07B

Ion and (implicitly) electron hole conductivities and O2 semipermeabilities and their activation energies of commercial slip-cast Y2O3 doped ZrO2 were measured under conditions simulating their practical application. It appears to show promise as an O2 semipermeable membrane for ROC and electro-ROC type water splitters as well as components of devices for the gas-phase electrolytic separation of metals, Zn in this study, from their oxides. GRA

N87-27758# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE NATURE OF THERMAL IGNITION
Walter Gill, Demetrio Bastos Netto, and Joao AndradedeCarvalho, Jr. Jan. 1987 15 p Presented at the Explosives Seminar, Sao Jose dos Campos, Brazil, Oct. 1986; sponsored by DFVLR/CTA Joint Working Agreement
(INPE-4094-NTE/266) Avail: NTIS HC A02/MF A01

The mathematical treatment of the thermal ignition problem as introduced in a recent paper is reviewed and interpreted. It is established that the solution to the steady state ignition problem sets the limits for the time dependent analysis which will allow the more practical and complex ignition problems to be studied. Author

N87-27759# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EFFECT OF INERT GAS ON THE BURNING OF DOUBLE BASE POWDER [EFEITO DO GAS INERTE NA QUEIMA DE POLVORA DE BASE DUPLA]
Fernando FachiniFilho, Walter Gill, and Lucy deAlbuquerqueKimura May 1987 12 p In PORTUGUESE; ENGLISH summary Presented at the First Brazilian Symposium on Heat and Mass Transfer
(INPE-4180-RPE/542) Avail: NTIS HC A02/MF A01

Demonstrated is the lack of influence of the inert monatomic gases, helium and argon, on the burning rate of a solid propellant. It is concluded that the control mechanism of the combustion of the solid propellant is in the liquid or solid phase of the flame. If it were in the gaseous phase, the helium and argon would have influenced the burning rate; as is observed in the combustible gaseous mixture in the presence of these gases. Author

N87-27760# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
GAMMA RAY SPECTROMETRY OF INFINITE 4 pi GEOMETRY [ESPECTROMETRIA GAMA DE GEOMETRIA 4 PI INFINITA]
Daniel Jean Roger Nordemann Jul. 1987 23 p In PORTUGUESE; ENGLISH summary Presented at the 2nd Regional Geophysics Meeting (SBGf), Nov. 1987
(INPE-4233-PRE/1108) Avail: NTIS HC A02/MF A01

Because of the weak absorption of gamma radiation by matter, gamma-ray spectrometry may be applied to samples of great volume. A very interesting case is that of the gamma-ray spectrometry applied with 4-pi geometry around the detector on a sample assumed to be of infinite extension. The determination of suitable efficiencies allows this method to be quantitative. Author

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N87-27761# Sandia National Labs., Albuquerque, N. Mex.
CORROSION OF ION IMPLANTED AMORPHOUS ALLOYS
N. R. Sorensen, R. B. Diegle, and S. T. Picraux 1987 4 p
(Contract DE-AC04-76DP-00789)
(DE87-011061; SAND-87-1430) Avail: NTIS HC A02/MF A01

We are determining how alloy composition and structure interact to control the electrochemical behavior of amorphous alloys. Our program has two main goals: to understand how phosphorus influences the formation and breakdown of passive films on transition metal alloys, and to separate and quantify the individual roles of P and alloy structure in these processes. The work described herein primarily focusses on the first goal. We have investigated P implantation into Fe-Cr alloys at a sufficiently broad range of fluences to induce electrochemical effects resulting from the change in chemical composition, and also from the crystalline-to-amorphous structural transition. DOE

N87-27762# Netherlands Energy Research Foundation, Petten.
POSTIRRADIATION CREEP PROPERTIES OF FOUR PLATES AND TWO FORGINGS DIN 1.4948 STEEL FROM THE SNR-300 PERMANENT PRIMARY STRUCTURES
B. vanderSchaaf Jan. 1987 185 p
(ECN-192; B8701421; ETN-87-90178) Avail: NTIS HC A09/MF A01

After irradiation to neutron fluences relevant for SNR-300 service conditions, postirradiation tensile and creep tests were performed in the temperature range 723 to 923 K on 6 heats of austenitic stainless steel. All heats are embrittled by irradiation resulting in reduction of rupture times, creep strength, and tensile strength. The considerable reduction is attributed to helium enhanced intergranular creep crack growth, which reduces the ductility and strength, but does not affect the creep rate. The variation of tensile and creep properties is large and independent of irradiation. The minimum derived creep strength in irradiated condition drops below the values expected in the ASME Code and VdTuV Blatt. ESA

N87-27763# Netherlands Energy Research Foundation, Petten.
POSTIRRADIATION TENSILE, CREEP, AND CREEP RUPTURE DATA OF DIN 1.4948 STEEL WELD METAL, HEAT AFFECTED ZONES AND WELDED JOINTS OF THE SNR-300 PERMANENT PRIMARY STRUCTURES
B. vanderSchaaf Jan. 1987 165 p
(ECN-193; B8701492; ETN-87-90179) Avail: NTIS HC A08/MF A01

Full weld metal specimens from a wide groove weld were subjected to tensile and creep tests in as-deposited and stress-relieved condition. Heat-affected zones (HAZ) were simulated in full size standard specimens by subjecting raw cylinders to temperature cycles representative for HAZ. The tensile and creep properties of as-deposited and stress-relieved weld metal are not affected by the neutron irradiation. The HAZ shows a pronounced decrease in postirradiation tensile ductility and strength when decreasing the strain rate. The creep strength of welded joints is controlled by a strain limit criterion to prevent the HAZ becoming the weakest link of a welded joint after irradiation, grain growth and boron precipitation on grain boundaries must be suppressed. ESA

N87-27764# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
INFLUENCE OF A PAINT COATING AND WATER DISPLACING CORROSION INHIBITOR (WDCI) APPLICATION ON THE STRESS CORROSION CRACKING (SCC) BEHAVIOR OF ALUMINUM 7075 ALLOY
H. F. deJong and W. A. J. Moonen Jan. 1986 25 p
(VTH-LR-446; B8707428; ETN-87-90195) Avail: NTIS HC A02/MF A01

The influence of a low chromate and a high chromate paint system and a water displacing corrosion inhibitor (WDCI) on the stress corrosion cracking (SCC) of an aluminum 7075-T651 alloy was investigated. Bolt-loaded double cantilever beam specimens were tested in a salt spray environment. Results show that a paint coating or a WDCI-film promote a plateau region in the crack growth rate curves. This is possibly caused by the fact that for coated specimens the cathodic reactions are becoming rate controling, due to the limited area available for the cathodic processes. Although neither a paint coating nor a WDCI-film prevents SCC completely in precracked specimens, the crack growth rate may be reduced by a low chromate paint system or a WDCI. Crack growth rate increases when a high chromate paint system is used. ESA

N87-27765# Oak Ridge National Lab., Tenn.
APPLICATION OF ANALYTICAL ELECTRON MICROSCOPY TO DESIGN OF CREEP RESISTANT ADVANCED AUSTENITIC STAINLESS STEELS
P. J. Maziasz 1987 3 p Presented at the 45th Annual Meeting of the Electron Microscopy Society of America, Baltimore, Md., 2 Aug. 1987
(Contract DE-AC05-84OR-21400)
(DE87-003456; CONF-870862-3) Avail: NTIS HC A02/MF A01

Analytical electron microscopy (AEM) has been used to study fine particles (less than 10 nm in diam) on extraction replicas using high brightness electron sources like the field emission gun (FEG). These studies allowed alloy compositional modifications to be selected that produced stable, fine precipitates for creep strength. The creep resistance of advanced modified 14Cr-16Ni austenitics is greatly improved relative to type 316, alloy 800H or 17-14 CuMo at 700 C and a high stress of 170 MPa. AEM observations suggest that precipitates are primarily responsible for the improved creep strength. DOE

N87-27766# Lawrence Livermore National Lab., Calif.
CREEP OF AUSTENITIC STAINLESS STEELS AT ROOM TEMPERATURE
R. Castro, R. Tricot, and D. Rousseau Apr. 1987 52 p Transl. into ENGLISH of conference paper Fluage des Aciers Inoxydables Austenitiques a la Temperature Ambiante Presented at the Steel-strengthening Mechanisms Symposium, Zurich, Switzerland, 5 May 1969
(Contract W-7405-eng-48)
(DE87-009118; UCRL-Trans-12178; CONF-690588-1-Trans)
Avail: NTIS HC A04/MF A01

A notable characteristic of the room-temperature mechanical behavior of austenitic stainless steels is creep even under moderate loads. The magnitude of this creep has been studied on three steels with 0.06% C, 18% Cr and nickel contents of about 13, 8 and 7%, showing decreasing stability of the austenite to structural transformations induced by cooling to low temperatures and/or deformation. The nature and extent of these transformations are detailed and several examples are given of the morphology of the resultant constituents. Creep tests on specimens solution treated at 1050 C and air cooled were made at loads ranging from initial stresses below the conventional 0.2%-offset yield strength to initial stresses near the tensile strength. These tests showed that austenitic stainless steels generally follow a logarithmic creep law. The influence of structural transformations induced by deformation on this behavior is discussed. The occurrence of the austenite yields alpha' martensite (bcc) transformation is accompanied by a significant retardation of creep but without a noteworthy change in the nature of the responsible mechanism. Finally, these tests indicated that plastic deformation of austenitic stainless steels always favors - either by simple work hardening or by partial destabilization of the austenite - the adaptation of the mechanical strength of the metal to the applied loads. This behavior guarantees the safety of installations from rupture and demonstrates why rational utilization of austenitic stainless steels can be obtained only if allowable design stresses are not established merely by reference to the 0.2%-offset yield strength of the solution-treated alloy. DOE

N87-27767*# Electrink, Inc., San Diego, Calif.
SYNTHESIS OF ORGANOMETALLIC COMPOUNDS Final Technical Report
J. Parker 28 Jan. 1987 78 p
(Contract NAS7-1009)
(NASA-CR-180968; DOE/JPL-956985/1; NAS 1.26:180968; DE87-009559) Avail: NTIS HC A05/MF A01 CSCL 11F

Procedures are established which would allow the practical production of solutions of organometallic compounds suitable for the deposition of conductive metal films at temperatures below 250 C. Purdue University's Turner Laboratory developed the basic chemistry for the synthesis of these oxygen bridge organometallic compounds. A solution of a metal salt is combined with a solution of an ammonium (or amine) soap of an appropriate organic acid. The resulting precipitate is cleaned, dried and dissolved in xylene. Control of pH and reagent purity was essential in producing useful quantities in better than 75% yields and at reasonable costs. Processes were developed for silver, bismuth, platinum, nickel, and gold organometallic products. The processes for the gold and platinum products remained difficult, giving low yields and evidence of poor product stability. It is anticipated that improvement in the removal of inorganic impurities from the product would enhance its stability. Thermal analyses were applied to the products to determine their decomposition characteristics, and rough cost studies were made to aid in comparisons with conventional metallization methods. DOE

N87-27768# Los Alamos National Lab., N. Mex.
SHOCK WAVE EFFECTS AND METALLURGICAL PARAMETERS
K. P. Staudhammer 18 May 1987 19 p Presented at IMPACT '87, Bremen, West Germany, 18 May 1987
(Contract W-7405-eng-36)
(DE87-010115; LA-UR-87-1609; CONF-8705109-5) Avail: NTIS HC A02/MF A01

This review summarizes results from some principal investigations of shock-strain effects in metals. The strain contribution indeed plays a role in residual microstructures, particularly, if the strain becomes dominant as in under trapped experiments of low or moderate pressure or for that matter, of well trapped high pressure experiments. Not only does this strain contribution affect the microstructure by increasing deformation, a concommitant strain heat is generated and absorbed by the shocked material. This strain heat, if large enough (relative to the homologous temperature of the material), can and does have an annealing effect on the residual microstructure. This strain heat is over and above the values typically calculated for materials implying little or no strain. Although the accumulative effects of associated strain are not completely definite, the collective picture presented is one in which shock-induced strains, when large enough, have a significant effect on the residual microstructure. DOE

N87-27769# Florida Univ., Gainesville.
MODERATE AND LOW TEMPERATURE OXIDATION OF CLEAN NICKEL, CHROMIUM, AND NI-Cr ALLOYS Progress Report, 1 Aug. 1986 - 31 Jul. 1987
P. H. Holloway and C. D. Batich Apr. 1987 10 p
(Contract DE-FG05-84ER-45155)
(DE87-011089; DOE/ER-45155/3) Avail: NTIS HC A02/MF A01

Metals are inherently thermodynamically unstable and will react with atmospheric gases or water to produce oxide, hydrated oxides, etc. Normally this product will degrade the mechanical, physical, etc., properties of the metallic part. Fortunately the oxides produced by the reactions usually reduce the rate of subsequent reaction making it feasible to build structures with metals. It has been found for stainless steels and nichrome alloys that the addition of chromium (Cr) significantly improves the ability of the oxides to passivate (reduce the reaction rate of) the metallic surface. However because Cr is a strategic material whose supply is controlled by countries other than the US, it is important to develop a scientific basis for substituting other elements for Cr in metallic alloys. This paper reports on the fundamental study of the development of passivating oxide films on Ni-Cr alloys. DOE

N87-27770# Oak Ridge National Lab., Tenn.
PROCUREMENT AND SCREENING TEST DATA FOR ADVANCED AUSTENITIC ALLOYS FOR 650 DEGREES C STEAM SERVICE (PART 1, 14Cr-16Ni STEELS AND 20Cr-30Ni-Fe ALLOYS)
R. W. Swindeman, G. M. Goodwin, and P. J. Maziasz Apr. 1987 65 p
(Contract DE-AC05-84OR-21400)
(DE87-011959; ORNL/TM-10206/P1) Avail: NTIS HC A04/MF A01

Tests were initiated to evaluate the potential of a group of developmental iron-nickel-chromium alloys for service at 700°C with a target design stress of 60 MPa. Tensile, creep, stress rupture, weldability, and microstructural stability tests were conducted on one group of alloys, which are essentially modifications of type 316 stainless steel. The data for the alloys were compared to data for type 316 stainless steel, alloy 800H, and 17-14CuMo stainless steel. Results of the short-time screening tests indicate that the developmental alloys are superior to the commercial alloys in regard to strength. Annealing at 1115°C produced a loss in strength, but it was found that the loss could be mitigated by the judicious selection of composition, annealing conditions, and cold work prior to aging. The alloys were found to be unsatisfactory in regard to autogenous weldability; they exhibited a tendency for hot cracking. However, the steels could be joined satisfactorily with Inconel 82 and 17-14CuMo stainless steel filler metals. Compositions were identified that will be produced as small heats of tubing for subsequent fabricability, corrosion, and mechanical testing. DOE

N87-27771*# Case Western Reserve Univ., Cleveland, Ohio.
DUCTILITY AND FRACTURE IN B2 FeAl ALLOYS Ph.D. Thesis Final Report
Martin A. Crimp Aug. 1987 220 p
(Grant NAG3-563)
(NASA-CR-180810; NAS 1.26:180810) Avail: NTIS HC A10/MF A01 CSCL 11F

The mechanical behavior of B2FeAl alloys was studied. Stoichiometric Fe-50Al exhibits totally brittle behavior while iron-rich Fe-40Al yields and displays about 3% total strain. This change in behavior results from large decreases in the yield strength with iron-rich deviations from stoichiometry while the fracture stress remains essentially constant. Single crystal studies show that these yield strength decreases are directly related to decreases in the critical resolved shear stress for a group of zone axes /111/ set of (110) planes slip. This behavior is rationalized in terms of the decrease in antiphase boundary energy with decreasing aluminum content. The addition of boron results in improvements in the mechanical behavior of alloys on the iron-rich side of stoichiometry. These improvements are increased brittle fracture stresses of near-stoichiometric alloys, and enhanced ductility of up to 6% in Fe-40Al. These effects were attributed to increased grain boundary adhesion as reflected by changes in fracture mode from intergranular to transgranular failure. The increases in yield strength, which are observed in both polycrystals and single crystals, result from the quenching in of large numbers of thermal vacancies. Hall-Petch plots show that the cooling rate effects are a direct result of changes in the Hall-Petch intercept/lattice resistance flow. Author

N87-27772# Du Pont de Nemours (E. I.) and Co., Aiken, S.C.
LUBRICATION AND SURFACE FINISH OF EXTRUDED ALUMINUM
A. C. Thompson and H. B. Peacock 1986 6 p Presented at the American Society of Metals Materials Week, Lake Buena Vista, Fla., 6 Oct. 1986
(Contract DE-AC09-76SR-00001)
(DE87-010164; DP-MS-86-151; CONF-861063-6) Avail: NTIS HC A02/MF A01

Tests were conducted at the Savannah River Laboratory to evaluate lubricants for possible replacement of a lead powder and oil mixture. The lead mixture is currently used to lubricate billets and tooling in the extrusion of Type 8001 aluminum. Three alternative lubricants were tested. Each of these contained graphite and oil, and two had additives. Billets were extruded at 440 C through a conical die. The lubricating ability of each lubricant was judged by surface finish of the extruded billet and by extrusion pressure. None of the lubricants tested is a suitable replacement. DOE

N87-27773# Sandia National Labs., Albuquerque, N. Mex.
A STRAIN-RATE-DEPENDENT SPALL MECHANISM TRANSITION IN METALS
D. E. Grady 1987 4 p Presented at the APS Topical Conference on Shock Waves in Condensed Matter, Monterey, Calif., 20 Jul. 1987
(Contract DE-AC04-76DP-00789)
(DE87-011637; SAND-87-0741C; CONF-870769-1) Avail: NTIS HC A02/MF A01

A prediction of the spall strength of metals in reasonable accord with experimental data can be derived from an energy-balance theory of the spall process. In the theory a model of ductile spall (Y-dominated ductile hole growth and coalescence) and brittle spall (K/sub c/-dominated crack growth and coalescence) is assumed. In the present study it is proposed that in certain metals a transition from brittle (K/sub c/-dominated) to ductile (Y-dominated) spall can occur with variation in the rate of dilatant strain. The predicted behavior is compared with spall data for 6061-T6 aluminum, for which this transition is calculated to occur at rates consistent with common impact applications. DOE

N87-27774# Los Alamos National Lab., N. Mex.
INFLUENCE OF PEAK PRESSURE ON THE SUBSTRUCTURE EVOLUTION AND MECHANICAL PROPERTIES OF SHOCK-LOADED 6061-T6 ALUMINUM
G. T. Gray, III and P. S. Follansbee 1987 11 p Presented at the 5th Topical Conference of the American Physical Society on Shockwaves in Condensed Matter, Monterey, Calif., 20 Jul. 1987
(Contract W-7405-eng-36)
(DE87-011743; LA-UR-87-2134; CONF-870753-8) Avail: NTIS HC A02/MF A01

Systematic shock recovery experiments have been performed on 6061-T6 Al shocked to pressures of 2, 8, and 13 GPa for 1 second pulse durations. Compression samples EDM machined from the recovered samples show that the mechanical behavior of 6061-T6 saturates rapidly under shock loading. Electron microscope examination reveals a random high dislocation density substructure, different from that observed in other shock-loaded aluminum alloys. Substructure evolution and mechanical response are discussed in light of the influence of strengthening mechanisms and shock recovery techniques. DOE

N87-27775# Cornell Univ., Ithaca, N.Y. Dept. of Materials Science and Engineering.
THE STRENGTHENING MECHANISMS IN MODIFIED AISI 316 STAINLESS STEELS
R. A. Carolan, Che-Yu Li, P. J. Maziasz, R. W. Swindeman, and J. A. Todd Apr. 1987 51 p Prepared in cooperation with ORNL, Tenn.
(Contract DE-AC05-84OR-21400)
(DE87-011983; ORNL/Sub-85-27488/01) Avail: NTIS HC A04/MF A01

The flow strength of a series of modified type AISI 316 austenitic stainless steels with stabilizing additions and with combined copper and stabilizing additions were evaluated after various thermo-mechanical treatments at elevated temperatures by using the load relaxation technique. The test results showed that there is a synergistic increase in strength when both copper and stabilizing additions are made and combined with prior cold work before stabilization treatment. Microstructural examination showed that copper increases the nucleation rate of MC type precipitation on grain matrix dislocations produced by cold work creating a fine distribution of these precipitates. This precipitation process enhances the strength of the steels and improves microstructural stability at elevated temperatures. DOE

N87-27776# Rockwell International Corp., Golden, Colo.
ACOUSTIC EMISSION PRODUCED BY DEFORMATION OF METALS AND ALLOYS
C. R. Heiple, ed., S. H. Carpenter, ed., and R. L. Thomas, ed. Mar. 1987 82 p
(Contract DE-AC04-76DP-03533)
(DE87-012300; RFP-4046) Avail: NTIS HC A05/MF A01

Acoustic emission is frequently produced during deformation of metals and alloys. Numerous mechanisms can be responsible for the acoustic emission activity. This report is a comprehensive review of the literature concerning acoustic emission produced during deformation by dislocation motion, deformation twinning, as well as inclusion fracture and decohesion. DOE

N87-27777# Sandia National Labs., Albuquerque, N. Mex.
SHOCK-MODIFIED TRANSITION METAL FERRITES
E. L. Venturini, B. Morosin, R. A. Graham, D. L. Williamson, and F. L. Williams Jun. 1987 68 p Prepared in cooperation with Colorado School of Mines, Golden and New Mexico Univ., Albuquerque
(Contract DE-AC04-76DP-00789)
(DE87-012340; SAND-87-0315) Avail: NTIS HC A04/MF A01

The physical properties of four spinel-structure ferrite powders (copper, cobalt, nickel and iron ferrite), subjected to high pressure shock loading and preserved for post-shock analysis, have been studied by X-ray diffraction, static magnetization and Moessbauer spectroscopy. X-ray diffraction shows residual strains typically greater than 0.1%, indicative of large shock-induced plastic deformation. Static magnetization reveals major strain-induced changes in magnetostrictive energies of magnitudes comparable to magnetocrystalline energies. At high applied magnetic fields it is found that saturation magnetization, magnetic hardness and magnetic susceptibility are strongly altered by the shock-modification process. Moessbauer measurements show apparent changes in magnetic-ion site distributions attributed to a reduction in crystallite size. There is evidence that about 15% of the magnetite is converted to hematite by the shock process. In summary, the shock-modified ferrite powders show major changes in their magnetic characteristics. Shock modification is shown to be an effective process to achieve unique states in these materials. DOE

N87-27778# Army Armament Research and Development Command, Watervliet, N. Y. Weapons Lab.
VARIATIONS IN THE BAINITE HARDENABILITY OF ASTM A723 STEEL Final Report
Paul J. Cote, Lawrence V. Meisel, and William Sheldon May 1987 22 p
(AD-A181905; ARCCB-TR-87012) Avail: NTIS HC A02/MF A01 CSCL 11F

Austenite transformation characteristics were determined for ASTM A723 steels prepared by various suppliers and refining methods. Standard measurement techniques as well as differential thermal analysis and thermomagnetic analysis were employed. Remarkably large variations in hardenability are found among these steels; the variations appear to be due to differences of less than one percent in the nickel content among the samples. These hardenability properties are shown to correlate in a straightforward way with mechanical properties of large size components that were quenched at different rates. GRA

N87-27779# Naval Postgraduate School, Monterey, Calif.
THE EFFECT OF PROCESSING AND SUPERPLASTIC DEFORMATION ON AMBIENT DUCTILITY OF Al-10 PERCENTMg-0.1 PERCENTZr M.S. Thesis
Dimosthenis K. Solomos Mar. 1987 87 p
(AD-A182067) Avail: NTIS HC A05/MF A01 CSCL 11F

In previous work, the room temperature mechanical properties of an Al-10Mg-0.1Zr alloy were evaluated after simulated,

superplastic forming at a temperature of 300 C (573K). A variation of ductility from 1 to 14% elongation was observed in the room temperature test data. To examine the cause of this variability, the processing schedule was changed to one incorporating more severe reductions during rolling. This resulted in a lesser range of variability in room temperature ductility, but the material no longer behaved superplastically. Elongations at 300 C of only 161% at a maximum were recorded although the small grain size required for good superplasticity apparently was developed. SEM and optical microscopy was then done to investigate the cause of this loss of superplastic behavior. GRA

N87-27780# Naval Air Development Center, Warminster, Pa. Air Vehicle and Crew Systems Technology Directorate.
CORROSION BEHAVIOR OF METAL MATRIX COMPOSITES Final Report, Jun. 1985 - Jun. 1986
R. C. Paciej and V. S. Argarwala Feb. 1987 19 p
(AD-A182133; NADC-87029-60) Avail: NTIS HC A02/MF A01 CSCL 11D

Metal-matrix composites suffer from preferential corrosion because of their non-homogeneous composition and structure. In particular, aluminum alloy matrix materials are very susceptible to corrosion, when the dispersoid is a noble phase, such as SiC. This paper describes the pros and cons of what inadequate processing and fabrication can do to corrosion behavior of the composites. GRA

N87-27781# Virginia Univ., Charlottesville. Dept. of Materials Science.
INVESTIGATION OF THE ELASTIC BEHAVIOR OF Al-Li-X ALLOYS Final Report, 1 Jun. 1985 - 31 May 1987
Wolfgang W. Ruch and E. A. Starke, Jr. 1 Jun. 1987 110 p
(Contract N00014-85-K-0526)
(AD-A182154; UVA/525400/MS87/102) Avail: NTIS HC A06/MF A01 CSCL 11F

Several Al alloys were investigated. The Young's modulus, shear modulus and Poisson's ratio were determined using an ultrasonic pulse echo technique. The elastic properties were measured as a function of aging time, aging temperature, amount of stretching and testing direction. An increase in Young's modulus due to delta prime and Ti precipitation has been measured and treated quantitatively including precipitation kinetics. A significant decrease of about 5% in the modulus of elasticity can be found in peak age conditions. This decrease can be attributed to precipitation of the T2 phase. The shear modulus behaves similar to Young's modulus while the Poisson's ratio remains unchanged. There is no significant orientation dependence of the elastic properties on testing direction despite the fact that a typical rolling texture was present. GRA

N87-27782# State Univ. of New York, Buffalo. Dept. of Chemistry.
ENERGY TRANSFER THEORY FOR THE CLASSICAL DECAY RATES OF MOLECULES AT ROUGH METALLIC SURFACES
P. T. Leung and Thomas F. George Jun. 1987 34 p
(Contract N00014-86-K-0043)
(AD-A182238; UBUFFALO/DC/87/TR-42) Avail: NTIS HC A03/MF A01 CSCL 10A

The problem of the decay rates for molecules at rough metallic surfaces is considered, where the classical electromagnetic energy transfer theory of Chance, Prock and Silbey for a slat surface is generalized to the case of a rough boundary. A dynamic theory is constructed through the combination of the Sommerfeld antenna theory and the integral equation formalism of Maxwell's equation at rough boundaries established mainly by Maradudin, Mills and Agarwal. Perturbative solutions are obtained and numerical results are given which previously from the application of the image field theory, show that this latter theory can be very inaccurate for cases involving highly-conducting substrates or large molecule-surface distances, consistent with previous observations for the case of flat surfaces. GRA

N87-27783# Materials Research Labs., Ascot Vale (Australia).
FATIGUE-FRACTURE PROPERTIES OF A SEMI-AUSTENITIC PH STAINLESS STEEL
R. Farrara Feb. 1987 29 p
(AD-A182295; MRL-R-1041) Avail: NTIS HC A03/MF A01 CSCL 11F

Fatigue and fracture toughness properties were determined for STA60 precipitation hardening stainless steel used in the structure of the 105 mm Light Gun. Fatigue properties (S-N crack for initiation and crack growth rate) and fracture toughness were measured on both parent sheet and welded joints for a range of heat treatments including fully re-heat treated and peak aged (450 deg C), overaged as in production (530 deg C), and as-welded joints not re-heat treated. The material was found to be notch sensitive. Fatigue crack growth was much faster, and fracture toughness much lower, in the longitudinal (rolling) direction of sheet because of the presence of nonmetallic stringers in the microstructure. Overaging had little effect on fatigue properties compared with peak ageing, but did achieve a significant improvement in fracture toughness. Weld metal was more resistant to fatigue crack initiation than parent sheet, but welds not re-heat treated were drastically limited in all three properties because the weld heat-affected zones remained in the soft condition. GRA

N87-27784# Material Concepts, Inc., Columbus, Ohio.
DISCONTINUOUS REINFORCED MMC (METAL MATRIX COMPOSITE) BY IMPROVED SONIC DISTRIBUTION OF SiC INTO MOLTEN ALUMINUM Final Technical Report, 28 Jun. 1985 - 28 Feb. 1987
Ralph F. Orban and David M. Goddard 28 Feb. 1987 66 p
(Contract DAAK70-85-C-0065)
(AD-A182321; MCI-86-0182) Avail: NTIS HC A04/MF A01 CSCL 11D

A month program investigated the use of sonic energy to form a discontinuous SiC/Al metal matrix composite system. Predicated on the previous Phase I SBIR effort, this Phase II program involved the use of a sonic transducer to distribute SiC particulate into melts of molten aluminum. Although the program was plagued with the major problem of finding equipment which would operate under the necessary conditions, such a unit was identified and procured. Additions of 10 wt% were attempted with 520, 356, and pure aluminum. Greatest success was achieved with the 520 alloy, followed by the 356 alloy with successful additions of 10 and 7 wt%, respectively. Further, distribution of the particulate was fairly uniform. Other alternative methods of producing discontinuous SiC/Al were also investigated including mixing with an impeller and use of a proprietary coating on the SiC particulate. GRA

N87-27785# Naval Postgraduate School, Monterey, Calif.
PROCESSING AND SUPERPLASTICITY IN LITHIUM-CONTAINING Al-Mg ALLOYS M.S. Thesis
Benjamin W. Sanchez Mar. 1987 53 p
(AD-A182524) Avail: NTIS HC A04/MF A01 CSCL 11F

The refined microstructures and superplastic properties resulting from controlled thermomechanical processing of aluminum magnesium lithium zirconium alloy were evaluated. The processing involved warm rolling at 300 C separately to true strains of 1.9 and 2.6. Increasing the rolling strain enhanced the superplastic ductility of the alloy at 300 C. Elongations in excess of 500 percent without cavitation, and a corresponding strain rate sensitivity coefficient of approximately 0.5, were obtained. TEM investigations of the microstructural characteristics responsible for the mechanical behavior revealed that a more uniformiy refined grain structure (2 to 5 micrometer) evolved by continuous recrystallization in material experiencing the larger rolling strain. It was also concluded that the increase in rolling strain enhances grain refinement both preceding and concurrent with superplastic deformation. GRA

N87-27786# United Kingdom Atomic Energy Authority, Risley (England).
EFFECT OF STRESS TRIAXIALITY ON THE DUCTILE TEARING AND CLEAVAGE FRACTURE OF A MILD STEEL

F. M. Beremin 3 Jul. 1987 20 p Transl. into ENGLISH from Journal de Mecanique Appliquee (France), v. 4, no. 3, 1980 p 327-342
(BLL-Risley-Tr-5481-(1769-7F)) Copyright Avail: British Library Lending Div., Boston Spa, Engl.

A A 508 (AFNOR 15 DM6) steel was tested using circumferentially notched specimens. At -196 C, all specimens fractured by a cleavage process. The experimental results are explained by the existence of a critical tensile stress sigma c = 1.450 MPa. On the contrary, at +100 C, all specimens fracture through a ductile tearing process. The effect of stress triaxiality on each of the three steps of the ductile rupture is analyzed for a long direction as well as for a short transverse direction. A detailed analysis of the rupture surfaces was realized. Author

N87-27787 Central Electricity Generating Board, London (England). Translation Section, Overseas Service.
INVESTIGATING THE SERVICEABILITY OF WELD JOINTS IN PIPES MADE FROM 12Cr1MoV STEEL WITH A VIEW TO DISPENSING WITH HEAT TREATMENT
F. A. Khromchenko and L. D. Venderova [1987] 28 p Transl. into ENGLISH from Metals in Modern Power Generating Plants, Energia (Moscow, USSR), 1977 p 72-80
(CE-Trans-8272; BLL-CEGB-9022.09) Avail: Issuing Activity

Investigations were conducted into the stability of the structure and properties in the process of aging, and also in the brittle, long term and cyclic strength of weld joints in pipes with a diameter of less than 200 mm and a wall thickness of up to 20 mm made from 12Cr1MoV steel with seams comprising 10CrMo, 10CrMoV, Cr15Ni25Mo6 and Cr25Ni60Mo10 type compositions. It was found that the initial period of aging is the most dangerous and that it is characterized by increased sensitivity to brittle failure of weld joints with 10CrMoV and 10CrMo pearlitic weld metal. It is shown that heat treatment on high temperature tempering of weld joints with 10CrMoV weld metal is a necessary and obligatory technological operation, ensuring the required serviceability of a steam line. Confirmation was found regarding the assumption that the weak spot in weld joints comprising dissimilar steels is the fusion zone, in which brittle failure develops. It was found that non-heat treated weld joints with 10CrMo pearlitic weld metal without vanadium comply with requirements regarding brittle, long term and cyclic strength. Author

N87-27788 Central Electricity Generating Board, London (England). Translation Section, Overseas Service.
MICROCRACK GROWTH IN GRAIN BOUNDARIES AT THE SURFACE OF SMOOTH SPECIMENS OF 316 STAINLESS STEEL IN HIGH TEMPERATURE CREEP
Ryuichi Ohtani, Michio Okuno (Furukawa Electric Co. Ltd., Tokyo, Japan), and Ryosuke Shimizu [1987] 15 p Transl. into ENGLISH from Zairyo, J. Soc. Materials Sci. (Japan), v. 31, no. 344, 1982 p 505-509
(CE-Trans-8190; BLL-CEGB-9022.090) Avail: Issuing Activity

An investigation was carried out on the growth of microcracks in creep, and also whether the mechanical law governing macrocrack propagation applies also the growth of microcracks. This investigation helps to clarify the nature of creep fracture and also provides valuable pointers for the handling of defects or cracks in the creep strength evaluation of high temperature machinery and structures. Continuous observations were made of the growth of a large number of intergrandular surface microcracks to a magnitude of several crystal grain boundaries. The change of number of cracks, their density, surface length, shape in the internal direction, and opening displacement were measured as a function of time and the mechanical law governing the growth of individual cracks was also investigated. Author

N87-27789*# Marko Materials, Inc., North Billerica, Mass.
ADVANCED POWDER METALLURGY ALUMINUM ALLOYS VIA RAPID SOLIDIFICATION TECHNOLOGY, PHASE 2 Final Report, 1 Apr. 1985 - 31 Mar. 1987
Ranjan Ray and Sunil C. Jha Apr. 1987 185 p
(Contract NAS1-18001)
(NASA-CR-178356; NAS 1.26:178356) Avail: NTIS HC A09/MF A01 CSCL 11F

Marko's rapid solidification technology was applied to processing high strength aluminum alloys. Four classes of alloys, namely, Al-Li based (class 1), 2124 type (class 2), high temperature Al-Fe-Mo (class 3), and PM X7091 type (class 4) alloy, were produced as melt-spun ribbons. The ribbons were pulverized, cold compacted, hot-degassed, and consolidated through single or double stage extrusion. The mechanical properties of all four classes of alloys were measured at room and elevated temperatures and their microstructures were investigated optically and through electron microscopy. The microstructure of class 1 Al-Li-Mg alloy was predominantly unrecrystallized due to Zr addition. Yield strengths to the order of 50 Ksi were obtained, but tensile elongation in most cases remained below 2 percent. The class 2 alloys were modified composition of 2124 aluminum alloy, through addition of 0.6 weight percent Zr and 1 weight percent Ni. Nickel addition gave rise to a fine dispersion of intermetallic particles resisting coarsening during elevated temperature exposure. The class 2 alloy showed good combination of tensile strength and ductility and retained high strength after 1000 hour exposure at 177 C. The class 3 Al-Fe-Mo alloy showed high strength and good ductility both at room and high temperatures. The yield and tensile strength of class 4 alloy exceeded those of the commercial 7075 aluminum alloy. Author

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

For composite materials see *24 Composite Materials*.

N87-27790# American Inst. of Physics, New York.
ABSTRACTS OF PRESENTATION: INTERNATIONAL CONFERENCE ON STABILITY OF AMORPHOUS SILICON ALLOY MATERIALS AND DEVICES
1987 136 p Conference held at Palo Alto, Calif., 28 Jan. 1987 Prepared in cooperation with Midwest Research Inst., Golden, Colo. and New Energy Development Organization, Tokyo, Japan
(Contract DE-AC02-83CH-10093)
(DE87-001122; SERI/CP-211-3090; CONF-870116-Summs)
Avail: NTIS MF A01

The abstracts of the papers presented at the International Conference on the Stability of Amorphous Silicon Alloy Materials are included in this document. The actual papers will be published as an American Institute of Physics Conference Proceedings. DOE

N87-27791 Ohio State Univ., Columbus.
HYDROGEN ATTACK IN CERAMICS Ph.D. Thesis
Da-Tung Liang 1987 259 p
Avail: Univ. Microfilms Order No. DA8710022

The objective was to find out whether a phenomenon similar to hydrogen attack in metals can exist in ceramic systems. Hydrogen reduction of NiTiO sub 3-TiO sub 2 two-phase materials which were chosen as a model system is studied by thermogravimetric analysis and microstructural examination. The reduced structures clearly reveal that severe grain boundary cracking in the dense TiO sub 2 matrix results in volume expansion. The stress developed for crack formation and extension is most likely due to the entrapped water vapor which is generated from the preferential reduction of discrete NiTiO sub 3 particles. The reduction appears to take place layer by layer with a repeated process which consists of H sub 2 diffusion, chemical reaction and crack growth and interconnection. As a result, linear kinetics and crack growth are observed. Dissert. Abstr.

N87-27792# Centre d'Etudes et de Recherches, Toulouse (France). Dept. d'Etudes et de Recherches en Technologies Spatiales.

IMPROVING CONTAMINATION PLUS IRRADIATION TEST. PRESTUDY NUMBER 3. STUDY OF CONTAMINANT APPLICATION PROCEDURES. VOLUME 1: TESTS AND CONCLUSIONS Final Report [AMELIORATION DES ESSAIS CONTAMINATION PLUS IRRADIATION. PREETUDE NO. 3. ETUDES DES PROCEDURES D'APPLICATION DE CONTAMINANTS. TOME 1: ESSAIS ET CONCLUSIONS]

Ph. Millan, A. Paillous, C. Sable, and J. Siffre Paris, France ESA Jan. 1986 74 p In FRENCH

(Contract ESTEC-5781/83-NL-AB)

(CERT-4193-Vol-3; ESA-CR(P)-2328-Vol-3; ETN-87-99879) Avail: NTIS HC A04/MF A01

The contamination of three types of thermal protective coatings for space application was tested using the decomposition vapors of two types of adhesive. The deposits were controlled with quartz microscales before and after exposition to vacuum only, or vacuum combined with ultraviolet or proton radiation. The optical reflectance evolution was measured . It is concluded that both kinds of irradiation affect strongly the possibility of reflectance recovery after contamination. The results allow a better understanding of the degradation of the solar reflectance of satellite protective coatings. ESA

N87-27793# Centre d'Etudes et de Recherches, Toulouse (France). Dept. d'Etudes et de Recherches en Technologies Spatiales.

IMPROVING CONTAMINATION PLUS IRRADIATION TESTS. PRESTUDY NUMBER 3. STUDY OF CONTAMINATION APPLICATION PROCEDURES. VOLUME 2: DETAILED RESULTS Final Report [AMELIORATION DES ESSAIS CONTAMINATION PLUS IRRADIATION. PREETUDE NO. 3: ETUDE DES PROCEDURES D'APPLICATION DE CONTAMINANTS. TOME 2: RESULTATS DETAILLES]

Ph. Millan, A. Paillous, C. Sable, and J. Siffre Paris, France ESA Jan. 1986 207 p In FRENCH

(Contract ESTEC-5781/83-NL-AB)

(CERT-4193-Vol-4; ESA-CR(P)-2328-Vol-4; ETN-87-99880) Avail: NTIS HC A10/MF A01

The contamination of three types of thermal protective coatings for space application was tested using the decomposition vapors of two types of adhesive. The deposits were controlled with quartz microscales before and after exposition to vacuum only, or vacuum combined with ultraviolet or proton radiation. The optical reflectance evolution was measured. It is concluded that both kinds of irradiation affect strongly the possibility of reflectance recovery after contamination. The results allow a better understanding of the degradation of the solar reflectance of satellite protective coatings. ESA

N87-27794*# Virginia Commonwealth Univ., Richmond. Dept. of Chemistry.

SYNTHESIS OF THERMALLY STABLE POLYPYRAZOLES, POLYPYRIMIDINES AND OTHER HETEROAROMATIC POLYMERS Status Report, 1 Feb. 1985 - 31 Jan. 1986

R. G. Bass 5 Mar. 1986 53 p

(Grant NAG1-239)

(NASA-CR-181241; NAS 1.26:181241) Avail: NTIS HC A04/MF A01 CSCL 11B

As part of a continuing effort to prepare high performance-high temperature polymers for functional and structural applications, the reactions of aromatic dipropynones with aromatic dihydrazine, aromatic dithiols, and aromatic diamidines to provide polypyrazoles, polyenonesulfides, and polypyrimidines respectively were investigated. During the past year, it was demonstrated that polypyrazoles and polyenonesulfides may be prepared by the proposed procedures. However, the preparation of polypyrimidines was not achieved. The preparation and characterization of some polypyrazolones by reaction or aromatic dihydrazines with an activated diacetylenic diester was achieved. Author

N87-27795*# Clarkson Univ., Potsdam, N.Y.

THE EFFECTS OF MOLECULAR WEIGHT ON THE SINGLE LAP SHEAR CREEP AND CONSTANT STRAIN RATE BEHAVIOR OF THERMOPLASTIC POLYIMIDESULFONE ADHESIVE

Stanley K. Dembosky and Erol Sancaktar Feb. 1985 75 p

(Grant NAG1-284)

(NASA-CR-181243; NAS 1.26:181243) Avail: NTIS HC A04/MF A01 CSCL 11A

The bonded shear creep and constant strain rate behaviors of zero, one, and three percent endcapped thermoplastic polyimidesulfone adhesive were examined at room and elevated temperatures. Endcapping was accomplished by the addition of phthalic anhydrides. The primary objective was to determine the effects of molecular weight on the mechanical properties of the adhesive. Viscoelastic and nonlinear elastic constitutive equations were utilized to model the adhesive. Ludwik's and Crochet's relations were used to describe the experimental failure data. The effects of molecular weight changes on the above mentioned mechanical behavior were assessed. The viscoelastic Chase-Goldsmith and elastic nonlinear relations gave a good fit to the experimental stress strain behavior. Crochet's relations based on Maxwell and Chase-Goldsmith models were fit to delayed failure data. Ludwik's equations revealed negligible rate dependence. Ultimate stress levels and the safe levels for creep stresses were found to decrease as molecular weight was reduced. Author

N87-27796# Telic Corp., Santa Monica, Calif.

EVALUATION OF CERMET SELECTIVE ABSORBER COATINGS DEPOSITED BY VACUUM SPUTTERING Final Subcontract Report

J. A. Thornton and J. A. Lamb Mar. 1987 101 p

(Contract DE-AC02-83CH-10093)

(DE87-001167; SERI/STR-255-3040) Avail: NTIS HC A06/MF A01

A project to investigate the use of sputtering is discussed. The study describes experiments in which 24-inch long receiver tubes were coated with Pt/Al2O3 graded cermet coatings by sputtering. Three coatings were examined: (1) cermets with graded Pt composition and Al2O3 antireflection layers; and (3) Al2O3-M-Al2O3 type coatings with Pt/Al2O3 M-layers. Sputter codeposition was used to form the cermet layers. Direct RF-sputtering of alumina and dc-reactive sputtering of aluminum were investigated as methods for depositing the Al2O3. The RF-sputtered Al2O3 was found to yield coatings with superior thermal stability. Thus, all three coating configurations were stable in air at 600 C. Absorptances were in the range from 0.90 to 0.95. The study concluded that graded cermet coatings were the most useful of the three types examined; optimized coatings on Pt-coated glass substrates yield absorptances of 0.97 and room-temperature emittances of about 0.08; alternative IR reflector layer materials were limited to low-temperature applications; substrate surface polishing is important in affecting the optical properties and thermal stability of coatings deposited onto engineering substrates; and an Al2O3 diffusion barrier was required to achieve maximum thermal stability for coatings deposited onto the engineering substrates. DOE

N87-27797# Mound Lab., Miamisburg, Ohio.

MECHANICAL TESTING OF CARBON FOAM

C. W. Merten Apr. 1987 11 p Presented at the Advanced Materials Workshop, Livermore, Calif., 21 Apr. 1987

(Contract DE-AC04-76DP-00053)

(DE87-009197; MLM-3428(OP); CONF-8704140-1) Avail: NTIS HC A02/MF A01

A theoretical analysis has been performed which predicts the effect of eccentric loading on measured mechanical properties. A fixture which minimizes bending and eccentric loading has been described. Preliminary results of compression tests on low density carbon foam have also been reported. Finally, an experiment to verify the predicted effects of misalignment and eccentric loading has been conducted. The results of this experiment are consistent with values predicted by theory. DOE

N87-27798# Minnesota Univ., Minneapolis. Dept. of Chemical Engineering and Materials Science.
ANALYTICAL TEM OF GRAIN BOUNDARY PHASES IN YTTRIA-ZIRCONIA CERAMICS
M. L. Mecartney and P. Angelini 1987 3 p Presented at the 45th Annual Meeting of the Electron Microscopy Society of America, Baltimore, Md., 2 Aug. 1987 Prepared in cooperation with ORNL, Tenn.
(Contract DE-AC05-84OR-21400)
(DE87-010400; CONF-870862-8) Avail: NTIS HC A02/MF A01

Yttria-zirconia ceramics have a broad range of applications, from use as structural materials (tetragonal zirconia) to ionic conductors (cubic zirconia). Similar to many ceramic materials, these zirconia ceramics often contain small amounts of amorphous silicate phases at grain boundaries and multiple grain junctions. These phases are a result of impurities, introduced during processing or from the original raw material, or are deliberate additions to aid in the densification via liquid phase sintering. Despite the universality of these grain boundary phases, until now little work has been undertaken to understand their effect on the microstructural development, chemistry, and physical properties of the materials. Reported here are results analyzing a series of yttria doped zirconia ceramics to which deliberate additions of various glass phases have been added. The addition of various glass phases has been observed to have profoundly different effects on grain growth and chemical composition of yttria-zirconia ceramics. These effects can be correlated directly with the solubility of the ceramic constituents in the various amorphous phases, as determined by analytical TEM. DOE

N87-27799# Los Alamos National Lab., N. Mex.
WHISKER REINFORCED STRUCTURAL CERAMICS: PROGRESS IN THE VLS GROWTH AND USE OF LONG SILICON CARBIDE WHISKERS
F. D. Gac, P. D. Shalek, W. J. Parkinson, C. Edwards, and J. B. Price 1987 22 p Presented at the Fossil Energy Materials Program Conference, Oak Ridge, Tenn., 19 May 1987 Prepared in cooperation with Texas Tech Univ., Lubbock
(Contract W-7405-eng-36)
(DE87-011066; LA-UR-87-1673; CONF-8705103-5) Avail: NTIS HC A02/MF A01

A VLS (vapor-liquid-solid) whisker growth process, optimized for the production of short (approx. 10 mm lengths) SiC whiskers, was modified to produce greater than or equal to 25 mm long whiskers. In conjunction with this modification, a plan was developed for incorporating an artificial intelligence system to enhance the whisker growth process. An oriented whisker ribbon was produced from the long whiskers, as a step toward the development of a staple whisker yarn. DOE

N87-27800# Pacific Northwest Labs., Richland, Wash.
CERAMIC THERMAL BARRIER COATINGS WITH IMPROVED CORROSION RESISTANCE
J. T. Prater and E. L. Courtright Feb. 1987 6 p Presented at the International Conference on Metallurgical Coatings, San Diego, Calif., 23 Mar. 1987
(Contract DE-AC06-76RL-01830)
(DE87-011145; PNL-SA-14744; CONF-870388-10) Avail: NTIS HC A02/MF A01

A method for limiting the ingress of corrosive species into physical vapor deposited zirconia thermal barrier coatings by inserting dense ceramic sealing layers into the usual columnar (segmented) ceramic microstructure has been examined. The concept was evaluated by sputtering a series of ZrO2-2OY2O3 deposits onto In792 substrates coated with a CoCrAlY bondlayer. DOE

N87-27801# Pacific Northwest Labs., Richland, Wash.
THE NEED FOR MICROSTRUCTURAL CONTROL IN COATINGS EXPOSED TO SEVERE ENVIRONMENTS
E. L. Courtright Feb. 1987 35 p Presented at the International Conference on Metallurgical Coatings, San Diego, Calif., 23 Mar. 1987
(Contract DE-AC06-76RL-01830)
(DE87-011149; PNL-SA-14488; CONF-870388-9) Avail: NTIS HC A03/MF A01

Very fine grained or amorphous microstructures often improve the performance of coatings exposed to severe environments. Several examples are discussed to illustrate the desirability of controlling processing conditions to achieve microstructural control. In some cases, better environmental resistance is obtained from amorphous materials that exist in a metastable state of equilibrium. Since metastable phases are typically in a higher energy state, this observation is not intuitively obvious. For example, metastable glassy metal alloys exhibit significantly improved aqueous corrosion resistance. Here, the absence of grain boundaries appears to be the predominant factor. Very fine grained and amorphous optical coatings demonstrate improved laser damage resistance and better stability in the presence of humidity. It is suggested that compositional homogeneity is a principal factor in this performance. At high temperatures, the formation of protective glassy SiO provides better oxidation protection than the stable, higher melting point refractories because the concentration of lattice defects in the crystalline oxides allows unacceptably high oxygen diffusion rates. Amorphous silica performs better until higher temperatures lower the viscosity and offset its advantage. DOE

N87-27802# Argonne National Lab., Ill.
EFFECT OF FLAWS ON THE FRACTURE BEHAVIOR OF STRUCTURAL CERAMICS
J. P. Singh, R. A. Roberts, J. J. Vaitekunas, and W. A. Ellingson May 1987 17 p Presented at the Fossil Energy Materials Program Conference, Oak Ridge, Tenn., 19 May 1987
(Contract W-31-109-eng-38)
(DE87-011432; CONF-8705103-6) Avail: NTIS HC A02/MF A01

Fracture studies and nondestructive evaluation (NDE) were performed to detect and assess the effect of flaws on the fracture behavior of hot-pressed Si3N4 with Fe inclusions. The NDE methods used were through-transmission and backscatter ultrasound and low-kV contact radiography. The addition of 5 and 0.5 wt % Fe inclusions of 88 to 250 micron size reduced the strength of Si3N4 specimens by approximately 40 and 15%, respectively. Fractography indicated that failure occurred primarily from internal flaws which included Fe- and Si-rich inclusions and/or regions of Si3N4 matrix that were degraded as a result of reaction between Si3N4 and molten Fe. For Fe inclusion-induced internal flaws, the critical flaw sizes calculated by fracture mechanics were always larger than the fractographically measured flaw sizes. This observation suggested a local degradation in fracture toughness of Si3N4 matrix. A ratio, K, of approx. 3.5 to 4.2 appeared to exist between the calculated and measured values of the critical internal flaw sizes. The ratio K will have important implications for strength prediction based on observed flaw size. A comparison of the fractography and NDE results for the location of critical flaws indicated that the backscatter ultrasound method may be more suitable than through-transmission ultrasound or low-kV contact radiography for the detection of near-surface flaws. DOE

N87-27803# Technische Hogeschool, Delft (Netherlands).
STRUCTURAL RELAXATION IN SOME METALLIC GLASSES Ph.D. Thesis
Erik Huizer 1987 167 p
(ETN-87-90236) Avail: NTIS HC A08/MF A01

It is shown that the kinetics of structural relaxation in Fe40Ni40B20 can be consistently described with the mixed model of Van den Beukel et al (1984). In this model the observed changes in physical properties during structural relaxation can be separated in a topological short range ordering (TSRO) part and a non-TSRO part. The first part is irreversible and can be described in terms of the free volume model, with a single set of parameters, in particular with a single activation energy. The non-TSRO part is well described by the activation energy spectrum model with a wide, block shaped spectrum of activation energies. It is shown that the non-TSRO part can be subdivided in a reversible and an irreversible part. The reversible part is ascribed to chemical short

range ordering (CSRO). The kinetics of CSRO depend on the amount of free volume. The irreversible contribution is unexplained. ESA

N87-27804# Technische Hogeschool, Delft (Netherlands).
STRUCTURAL INVESTIGATIONS OF SOME METALLIC GLASSES Ph.D. Thesis
Jilt Sietsma 1987 190 p Sponsored by the Netherlands Research Foundation
(ETN-87-90237) Avail: NTIS HC A09/MF A01

The reduced radial distribution functions (rRDF) of metallic glasses were determined by neutron diffraction. The isotopic substitution method was used to determine partial rRDF's for the ternary glass Fe40Ni40B20', thus gaining a more detailed picture of the structure. In order to better interpret the rRDF's, the disordered crystal model was studied. The para-para-crystal used in a comparative study for a large number of binary glasses is introduced. Mainly the partial rRDF's are considered. The experimental partial RDF's for Ni81B19 are found to be characteristic for the structure of a large variety of metallic glasses. These partial RDF's indicate a medium range order similar to the (prismatic) medium range order in the DOe-structure. ESA

N87-27805# Mound Lab., Miamisburg, Ohio.
STRUCTURAL REFINEMENT AND DSC CHARACTERIZATION OF PEEK FIBER
Albert V. Fratini, Elisa M. Cross, and Ruth B. Whitaker 3 Jun. 1986 17 p
(Contract DE-AC04-76DP-00053)
(MLM-3355) Avail: NTIS HC A02/MF A01

The crystalline structure of oriented fibers of poly(aryletheretherketone) (PEEK) was analyzed by X-ray diffraction and refined by the Linked-Atom Least-Squares procedure. The conformation of chains, consisting of a six-aryl ring unit, is approximated by the refinement of a two-aryl ring unit within the orthorhombic unit subcell with dimensions: a = 7.83 +/- 0.02 A, b = 5.94 +/- 0.01 A, and c = 9.86 +/- 0.04 A. Certain constraints imposed by Pbcn space group symmetry are relaxed during refinement. The results of the two-ring refinement indicate that a single torsion angle can be used to describe the confirmation of the six-ring unit. The torsion angle corresponds to the average tilt of the phenylene rings out of the (100) face, and the best fit is obtained with an angle of 37 deg. The simulated powder diffraction pattern based on the atomic coordinates of the six-ring unit matches very closely previously reported patterns for a variety of PEEK specimens. The analysis supports, and extends to oriented fibers, the previously reported finding that space group Pbcn is a valid representation for the structure of PEEK. Differential scanning calorimetry (DSC) established that the PEEK samples were typical PEEK material. M.G.

N87-27806# Naval Air Development Center, Warminster, Pa. Air Vehicle and Crew Systems Technology Directorate.
DEVELOPMENT OF A PRIMER/TOPCOAT AND FLEXIBLE PRIMER FOR ALUMINUM Phase Report, Oct. 1984 - Sep. 1986
Charles R. Hegedus 20 Mar. 1987 36 p
(AD-A182132; NADC-87016-60) Avail: NTIS HC A03/MF A01 CSCL 11C

Two corrosion preventive organic coatings have been developed for use on aluminum and specifically for application on Navy aircraft. They provide two alternatives for improving aircraft paint systems. The first coating can be applied directly to an aluminum substrate and perform as a self-priming topcoat. It consists of a two component, aliphatic polyurethane binder with titanium dioxide, zinc molybdate, zinc phosphate, an organo-zinc salt, and titanium dioxide vesiculated bead pigments. This primer/topcoat meets or exceeds all of the critical performance requirements of the current Navy aircraft paint system: Mil-P-23377 epoxy primer and Mil-C-83286 polyurethane topcoat. It exhibits good adhesion, corrosion inhibition, flexibility, chemical and weather resistance. The use of this coating will reduce: Paint application and removal time and manpower; Aircraft weight; Aircraft downtime; and Volatile organic component (VOC) and chromate emissions. The second coating is a flexible primer which was developed using the above polyurethane binder. It contains strontium chromate zinc chromate, barium chromate, and zinc molybdate corrosion inhibiting pigments. The primer meets or exceeds all of the performance requirements of Mil-P-23377 and has significantly more flexibility. Aluminum specimens coated with the NADC flexible primer remained in 5% salt spray for one year without any corrosion of the aluminum or damage to the coating. GRA

N87-27807# Naval Weapons Center, China Lake, Calif.
MOLECULAR WEIGHT DETERMINATION OF ENERGETIC POLYMERS BY LOW-ANGLE LASER LIGHT SCATTERING Final Report, Mar. - Aug. 1986
R. J. Cramer Feb. 1987 30 p
(AD-A182149; AD-E900674; NWC-TP-6774) Avail: NTIS HC A03/MF A01 CSCL 07D

Accurate and absolute molecular weights for new propellant binders are determined with difficulty by conventional gel permeation chromatography (GPC) which relies upon known calibration standards. GRA

N87-27808# Texas Univ., Arlington. Dept. of Chemistry.
ELECTRONIC AND IONIC TRANSPORT IN POLYMERS Quarterly Technical Report, 16 Mar. - 15 Jun. 1987
Martin Pomerantz, John R. Reynolds, Krishnan Rajeshwar, Dennis S. Marynick, and Timothy D. Shaffer 10 Jun. 1987 7 p
(Contract N00014-86-K-0769)
(AD-A182277; QTR-3) Avail: NTIS HC A02/MF A01 CSCL 07D

An optoelectrochemical study of poly (1,2-dithienylethylene) showed a lower band gap than the parent polythiophene and that it is electrochemically switchable between oxidized and reduced states. Free standing films exhibit conductivities up to 15/Scm. The quartz crystal microbalance has been used to monitor charge transport in polypyrrole and the self-doped copolymer, poly (pyrrole-co-3-purrol-1-yl) propane sulfonate in a variety of electrolytes. Scanning electron microscopy has shown that the morphology of these polymers is similar. A recently developed spectroelectrochemical technique has demonstrated that proton migration accompanies redox switching in polpyrrole. PRDDO calculations of many N-substituted pyrroles have shown that the oxidation potential of benzylpyrroles most closely match that of pyrrole. C-1 binding energies of polypyrrole with alpha-alpha linkages and with alpha-beta and beta-beta defects have been calculated for comparison with XPS data. An extended series of metal Cu(II) and Ni(II) chelate model compounds of bis(2,5-dihydroxy benzaldehyde) ethylene diimine has been prepared which contain ether end-cap spacers of 6-10 methylene units. Thermal analysis has revealed that the Ni(II) complexes show only nematic behavior while the Cu(II) complexes show both smectic and nematic behavior. GRA

N87-27809# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemistry.
AROMATIC POLYESTER POLYSILOXANE BLOCK COPOLYMERS: MULTIPHASE TRANSPARENT DAMPING MATERIALS Final Report, 1 May 1984 - 30 Apr. 1985
James E. McGrath 2 Oct. 1986 341 p
(Grant AF-AFOSR-0201-83)
(AD-A182623; AFOSR-87-0176TR) Avail: NTIS HC A15/MF A01 CSCL 11I

The synthesis and characterization of multiphase, transparent block copolymers that are potential candidates for passive damping applications in large space structures are described. Relatively high molecular weight polysiloxane-polyarylester block copolymers were prepared by two different synthetic routes. A solution technique was used to synthesize well-defined, perfectly alternating block copolymers by reacting a disfunctional hydroxyl-terminated polyarylester obligomer. A second approach involved the preparation of a segmented (or random) block copolymer by an interfacial, phase-transfer technique in which various polyarylester block lengths are formed during the copolymerization by reacting bisphenol-A, terephthaloyl chloride, and isophthaloyl chloride with

a disfunctional aminopropyl-terminated siloxane block compositions (dimethyl, dimethyl-diphenyl, or dimethyl-trifluoro propylmethyl) were controlled. New siloxane-ester block copolymers were prepared and characterized. They are believed to be potentially useful materials for passive damping applications in the space environment. GRA

N87-27810*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FIBER REINFORCED CERAMIC MATERIAL Patent Application
15 Apr. 1987 14 p
(NASA-Case-LEW-14392-2; NAS 1.71:LEW-14392-2; US-Patent-Appl-SN-038560) Avail: NTIS HC A02/MF A01 CSCL 11B

A strong and tough SiC/RBSN composite material comprises silicon fibers and a reaction bonded silicon nitride (RBSN) matrix. This composite material may be used at elevated temperatures up to at least 1400 C. NASA

N87-27811*# National Aeronautics and Space Administration, Washington, D.C.
PRACTICAL SIGNIFICANCE AND CALCULATION OF SURFACE TENSION OF GLASS, ENAMELS AND GLAZES
A. Dietzel Aug. 1987 15 p Transl. into ENGLISH from Sprechsall (West Germany), v. 75, 1942 p 82-85 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TT-20097; NAS 1.77:20097) Avail: NTIS HC A02/MF A01 CSCL 11B

Surface tension is important in the formation of streaks in the whole procedure of enameling and glazing., in the action of TiO2 as opacifier, in the addition of borax to enamels, or metals to glasses, and in the corrosion of refractories by molten charges. By the use of known methods for measuring surface tension additive constants are found which give correct results within 1% with no discrepancy due to B2O2. Author

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N87-27812# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
CAPILLARY GC DETECTION METHODS FOR NITROGEN AND SULFUR COMPOUNDS IN SHALE-DERIVED JET PROPULSION FUELS Final Report, Mar. 1985 - Mar. 1986
Ellen M. Steward and Edward W. Pitzer Dec. 1986 43 p
(AD-A181865; AFWAL-TR-86-2043) Avail: NTIS HC A03/MF A01 CSCL 21D

Correlations have been drawn between nitrogen and sulfur content in jet propulsion fuel and poor fuel performance. Recent studies have suggested that certain nitrogen and sulfur compound classes are more detrimental to fuel performance than others. This report emphasizes the importance of knowing which nitrogen and sulfur compound classes are present in jet propulsion fuel and demonstrates the ability of several capillary gas chromatographic (GC) detectors to selectively detect individual nitrogen and sulfur compounds in these fuels. GRA

N87-27813# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
DETERMINATION OF THE REGRESSION RATE OF SOLID FUELS IN SOLID FUEL COMBUSTION CHAMBERS BY MEANS OF THE ULTRASONIC PULSE-ECHO TECHNIQUE. PART 1: THE MEASUREMENT TECHNIQUE
P. A. O. G. Korting, E. H. denHertog, and H. F. R. Schoeyer Apr. 1985 36 p Sponsored by the Netherlands Foundation for Technical Research, the Project Office of Energy Research, Technische Hogeschool, Delft, The Netherlands, and the Prins Maurits Lab. TNO Prepared in cooperation with Prins Maurits Lab. TNO
(VTH-LR-453; PML-185-C5; SFCC-18; B8707435; ETN-87-90202) Avail: NTIS HC A03/MF A01

An ultrasonic facility to study propellant grain combustion was developed. Immediately after ignition of the solid fuel a melting layer starts to develop. During the first seconds the propagation speed of this melting layer exceeds the regression rate of the burning fuel surface. After that, more or less steady state conditions are achieved during which the propagation speed of the melting layer equals the fuel regression rate. As the Ultrasonic Regression Rate Analyzer only follows the propagation speed of the melting layer, reliable results for the fuel regression rate are only obtained some seconds after ignition. ESA

N87-27814# Lawrence Livermore National Lab., Calif.
EXPLODING BRIDGE WIRE INITIATION OF HIGH EXPLOSIVES
A. M. Frank 1986 21 p Presented at the 11th Annual Joint Firing Systems Conference, Albuquerque, N. Mex., 15 Oct. 1986
(Contract W-7405-eng-48)
(DE87-010872; UCRL-95507; CONF-8610286-1-Summ) Avail: NTIS HC A02

A laboratory for the microscopic examination of exploding bridge wire (EBR) initiation of high explosives has been established to examine the partition of energy of the EBW and its mechanism(s) for transfer to high explosives (HE). Recently developed techniques in micro framing and streak photography and spectroscopy are used. A fireset and diagnostics have been built and electrical burst data compared with that predicted by the FIRESET code. A high resolution 15ns framing camera is currently functional and has been used to examine self illumination effects. Three illumination systems are being prepared to provide single short pulse (2nS) laser illumination, multiple pulse laser illumination and long pulse (microsecond) flashlamp illumination. These illuminators will allow various forms of direct micro-photography, shadow and Schlieren photography. These techniques will be used to provide direct measurement of shock velocities and histories. Also being investigated are the direct measurement of pressure in and behind the shock using the spectral shift in the fluorescence of certain dyes. For this application an intensified imaging spectrograph is being built. DOE

N87-27815# Army Research Office, Research Triangle Park, N. C.
ENERGETIC MATERIALS HAZARD INITIATION: DOD ASSESSMENT TEAM REPORT Final Report, Nov. 1985 - May 1987
Thom L. Boggs and Arthur M. Mellor 5 May 1987 159 p
(AD-A181932) Avail: NTIS HC A08/MF A01 CSCL 19A

The Army, Navy, and Air Force Energetic Materials Hazard Initiation Assessment Team (EMHIAT) was established in late 1985 to identify basic and applied research needs to mitigate hazards, particularly for solid rocket propellants, represented by unplanned initiation in manufacturing or handling fielded systems and during processing of energetic materials. The team has surveyed the solid rocket industry, the DOE contractor laboratories, and DOD efforts related to explosives, gun, and rocket propellants. Findings of the survey and a Long-range Plan for Hazards are summarized in the present report. In July 1986 the DOD Joint Requirements Oversight Council issued criteria for Insensitive Munitions, all of which contain energetic materials. EMHIAT strongly recommends the Plan documented here as essential to meeting these criteria in a cost effective and timely fashion. GRA

N87-27816# Partnership Ltd., Lawrenceville, N.J.
ADVANCED AIRCRAFT FUEL EVALUATION, PHASE 1 Final Report, Jun. 1986 - Jan. 1987
Partha S. Ganguli and Paul H. Kydd Mar. 1987 78 p
(Contract F33615-86-C-2663)
(AD-A182029; AFWAL-TR-87-2034) Avail: NTIS HC A05/MF A01 CSCL 21D

The objective of this project was to provide estimates of the availability, cost and quality of naphthenic hydrocarbon fuels for advanced hypersonic vehicle propulsion as a function of time. To accomplish this objective a proposed specification of the fuel was established. Potential sources of feedstocks were surveyed with particular attention to petroleum based refinery streams. Three promising feedstocks were identified in addition to purchased petroleum derived naphthalene, which served as the bases of comparison. Processing routes to convert the feeds to specification fuel were identified. These are based on existing refining technology and require no process innovation or research for successful fuel production. The samples of the proposed fuel substantially met the desired properties of the advanced fuel. In addition rate constants were derived for the hydrogenation of naphthalene and the cis--trans-isomerization of decalin. Other rate constants relevant to the production of advanced fuel from refinery feedstocks were also measured. The requirements for the design of the aircraft system to use these fuels were estimated. The availability and cost of advanced fuels from the identified refinery streams were estimated and a possible scenario for supplying this fuel through the year 2000 was developed. The advanced fuel in question is intended for application in hypersonic aircraft of the future, particularly those intended for high Mach flight. GRA

N87-27817# Army Armament Research and Development Command, Dover, N. J. Armament Engineering Directorate.
NON-NEWTONIAN LIQUID PROPELLANT (NNLP) SENSITIVITY: PRELIMINARY STUDIES Technical Report, Sep. 1986 - Apr. 1987
P. Hui and A. Bracuti Jun. 1987 24 p
(AD-A182104; AD-E951005; ARAED-TR-87020) Avail: NTIS HC A02/MF A01 CSCL 21I

Samples of non-Newtonian liquid propellants containing various concentrations of RDX, TAGN, and TAE tested for sensitivity to impact, friction and electrostatic discharge, and hot fragments (vulnerability) were compared against similar test results obtained from solid propellants (M30 and XM39 LOVA) and liquid propellants (NOS 365 and OTTO Fuel II). The data indicated that high energy non-Newtonian liquid propellants can be safely processed. GRA

N87-27818# Federal Aviation Agency, Atlantic City, N.J.
LABORATORY CHARACTERIZATION TESTS FOR ANTIMISTING FUEL Final Report
Joseph J. Wilson Mar. 1987 127 p
(AD-A182196; DOT/FAA/CT-86/23) Avail: NTIS HC A07/MF A01 CSCL 21D

Experiments have shown that FM-9 antimisting fuel had the potential for precluding the fine mist and associated fireball generation in aircraft post-crash situations while allowing for the restoration of the filtration and antomizing characteristics required for aircraft operation. The Federal Aviation Administration, the Aircraft Establishment, the National Aeronautics and Space Administration, the Jet Propulsion Laboratory, Southwest Research Institute, and Pratt and Whitney Aircraft developed many specialized laboratory characterization tests throughout the antimisting fuel program to evaluate the antimisting properties, the degradability, the composition, and rheological properties of FM-9 antimisting fuel and the physical properties of FM-9 slurry used in the inline blending process for antimisting fuel. This report documents all the laboratory characterization tests that were successfully developed and used as a standardized test method during the program. GRA

N87-27819# Strat Co., Salt Lake City, Utah.
PRODUCTION OF HIGH ENERGY AVIATION FUELS FROM ADVANCED COAL LIQUIDS, PHASE 1 Final Report, Jun. 1986 - Feb. 1987
John Downen Apr. 1987 80 p
(Contract F33615-86-C-2660)
(AD-A182333; AFWAL-TR-87-2036) Avail: NTIS HC A05/MF A01 CSCL 21B

The objective of this program was to assess the feasibility of producing advanced fuels from coal liquids. The coal liquids used in this program were produced from the Close Coupled Integrated Two Stage Liquifaction System (ISTL) plant at Wilsonville, Alabama. The liquids were derived from subituminous coal, Wydodack upper seam, from Gillete, Wyoming. The coal liquids were distilled into a 300 to 625 F fraction. Hydrogenation experiments were conducted on this distillate fraction using the Hydrogenation Reactor System (HRS) located at Wright-Patterson AFB, Ohio. Shell 424 nickel/molybdenum catalyst was used for heteroatom removal and aromatics saturation. The report details the analysis of these hydrogenated candidate fuels. GRA

29 MATERIALS PROCESSING

Includes space-based development of products and processes for commercial applications.
For biological materials see *55 Space Biology.*

N87-27692# Joint Publications Research Service, Arlington, Va.
GRISHIN ON DEVELOPMENT OF ORBITAL PRODUCTION FACILITIES
Yu. Meshkov *In its* USSR Report: Space 21 Apr. 1986 p 62-66 Transl. into ENGLISH from NTR: Problemy i Resheniya (Moscow, USSR), no. 2, 21 Jan. - 3 Feb. 1986 p 8 (For primary document see N87-27687 22-12)
Avail: NTIS HC A07/MF A01

N87-27695# Joint Publications Research Service, Arlington, Va.
PROGRESS IN THEORY, TECHNOLOGY OF SPACE MATERIALS SCIENCE
Yu. Osipyan *In its* USSR Report: Space 21 Apr. 1986 p 97-99 Transl. into ENGLISH from Pravda (Moscow, USSR), 12 Nov. 1985 p 3 (For primary document see N87-27687 22-12)
Avail: NTIS HC A07/MF A01

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

N87-27820# Centre National d'Etudes Spatiales, Toulouse (France).
STUDY OF THE IMPLEMENTATION PARAMETERS OF THE CRIMPING CONNECTION PROCEDURE [ETUDE DES PARAMETRES DE MISE EN OEUVRE DE LA TECHNIQUE DE LIAISON PAR SERTISSAGE]
Serge Clement and Francois deBentzmann Feb. 1987 69 p In FRENCH; ENGLISH summary
(CNES-NT-119; ETN-87-90119) Avail: NTIS HC A04/MF A01

The optimization of electric connection procedures for space applications is discussed. The manufacturing parameters, and especially the optimal crimping force for different combinations of cable and connector, are analyzed. The case of two cables in one connector is studied. It is concluded that the validity of the procedure is confirmed, but the possibility of two cables in one connector is considered less interesting due to higher defect probability. ESA

N87-27821# Joint Publications Research Service, Arlington, Va.
USSR REPORT: ELECTRONICS AND ELECTRICAL ENGINEERING
6 Aug. 1987 85 p Transl. into ENGLISH from various Russian articles
(JPRS-UEE-87-008) Avail: NTIS HC A05/MF A01

Topics addressed include: acoustics, speech, signal processing, antennas, aerospace systems, electronic systems, broadcasting, circuits, communications, computers, industrial electronics, control instruments, instrumentation and measurements, microwave theory, power engineering, quantum electronics, electro-optics, solid state circuits, and ultrasonics. For individual titles, see N87-27822 through N87-27828.

N87-27822# Joint Publications Research Service, Arlington, Va.
BISTATIC RADAR USING COSMIC RADIO EMISSIONS Abstract Only c32
A. G. Pavelyev and A. I. Kucheryavenkov *In its* USSR Report: Electronics and Electrical Engineering 6 Aug. 1987 p 7 Transl. into ENGLISH from Izvestiya Vysshikh Uchebnykh Zavedeniy: Radiofizika (Gorkiy, USSR), v. 29, no. 8, Aug. 1986 p 871-877 (For primary document see N87-27821 22-31)
Avail: NTIS HC A05/MF A01

A radar receiving system can be used to ascertain the correlation function of a radio emission from space and then analyze the parameters of the same signal reflected from the surface of a planet. Information derived from these two measurements reveals the distance between the antenna and the planet surface, the surface layer density, its layered structure and other features. The angular size of the portion of the emission source used for the radar sensing can also be determined as a function of the wavelength and distance to the planet. This in turn enables an analytical correlation determination of the distribution of the emission intensity over the celestial sphere. A mathematical demonstration of the feasibility of this approach is presented. The feasibility depends on the anticipated signal to noise ratio; it is shown that the ratio of the useful signal to noise fluctuations at the correlator output is directly proportional to the ratio of the square of the wavelength to the altitude. Author

N87-27823# Joint Publications Research Service, Arlington, Va.
POSSIBILITIES OF USING COSMIC RADIATION SOURCES FOR LUNAR AND PLANETARY RESEARCH Abstract Only c32
N. A. Armand, A. G. Pavelyev, A. I. Kucheryavenkov, and D. Ya. Shtern *In its* USSR Report: Electronics and Electrical Engineering 6 Aug. 1987 p 8 Transl. into ENGLISH from Radiotekhnika i Elektronika (Moscow, USSR), v. 31, no. 8, Aug. 1986 p 1620-1626 Original language document was announced in IAA as A87-17514 (For primary document see N87-27821 22-31)
Avail: NTIS HC A05/MF A01

The possibility of the two-position radar sounding of the Moon and other planets using the natural kilometric emission of the Earth and other sources is examined. It is suggested that the radio sounding of the soil and plasmasphere of the Moon and other planets using terrestrial emission in the 100 to 500 kHz range is already possible. In studies of the Moon and Mercury, the maximum sounding depth of the soil appears to be 10 km. In the proposed scheme, it is proposed that the reflected radio emission be received by an artificial planetary satellite. IAA

N87-27824# Joint Publications Research Service, Arlington, Va.
REMOTE SENSING OF ATMOSPHERE TEMPERATURE FROM SPACTRAL RADIOMETRIC MEASUREMENTS AT 5 MILLIMETER WAVELENGTH LINE Abstract Only c43
A. V. Troitskiy *In its* USSR Report: Electronics and Electrical Engineering 6 Aug. 1987 p 9 Transl. into ENGLISH from Izvestiya Vysshikh Uchebnykh Zavedeniy: Radiofizika (Gorkiy, USSR), v. 29, no. 8, Aug. 1986 p 878-887 (For primary document see N87-27821 22-31)
Avail: NTIS HC A05/MF A01

The altitude profile of atmospheric temperature can be determined from ground-based measurements of the atmospheric radio emissions using the slope of the 5 mm oxygen absorption line. The best trade-off between precision and speed is obtained using a combination method that provides for sensing at three frequencies covering an analysis band of about 2 GHz at two different angles. The requirements for the optimal sensing frequencies and angles in the trophosphere for altitudes of 0 to 10 km were defined. A multichannel semiconductor radiometer developed by the Radiophysics Scientific Research Institute is described: a superheterodyne modulation type radiometer with a mixer at the input. A block diagram complements the description of its circuitry and data taken in June 1983 and January to February 1984 are used to plot the temperature profiles at altitudes from 0 to 10 km. Author

N87-27825# Joint Publications Research Service, Arlington, Va.
QUASI-OPTIMUM ALGORITHM OF SPACE-TIME SIGNAL PROCESSING BY LARGE ADAPTIVE ANTENNA ARRAY Abstract Only c32
V. N. Manzhos, V. N. Kokin, and N. I. Kamchatnyy *In its* USSR Report: Electronics and Electrical Engineering 6 Aug. 1987 p 15 Transl. into ENGLISH from Radiotekhnika (Moscow, USSR), no. 9, Sep. 1986 p 7-12 Original language document was announced in IAA as A87-21713 (For primary document see N87-27821 22-31)
Avail: NTIS HC A05/MF A01

A quasi-optimal algorithm is obtained for spatial signal processing in a large-aperture adaptive phases-array radar system. It is demonstrated that the algorithm provides for a high signal-processing efficiency in the case of a time lag of received signals over the envelope on the antenna aperture. This high efficiency is achieved through a preliminary compensation of noise present at the sidelobes of each module of the array. Simulation results confirm these findings. IAA

N87-27826# Joint Publications Research Service, Arlington, Va.
ACCURACY OF AZIMUTH OF MOVING TARGET MEASUREMENT BY RADAR WITH SYNTHESIZED APERTURE Abstract Only c32
A. T. Abrarov, V. N. Antipov, and G. S. Kondratenkov *In its* USSR Report: Electronics and Electrical Engineering 6 Aug. 1987 p 15-16 Transl. into ENGLISH from Radiotekhnika (Moscow, USSR), no. 9, Sep. 1986 p 18-21 (For primary document see N87-27821 22-31)
Avail: NTIS HC A05/MF A01

A radar with synthesized aperture is considered for measurement of the coordinates of a moving target, the attainable accuracy being dependent on the indeterminacy in the probing signal as well as that in the antenna aperture. The indeterminacy function with respect to three generally sought target coordinates is calculated for a probing pulse signal returning with a phase shift, with the amplitude-phase distribution in the aperture of the real antenna taken into account. The attainable accuracy is then estimated in terms of the corresponding error dispersion and found to depend principally on the dimensions of the real antenna, on the aperture synthesized step in the case of a stationary target. With regard to the tangential velocity, error dispersion and thus the attainable accuracy of measurement depend on the linear azimuth resolution and on the aperture synthesization step. With regard to the radial velocity, they depend on the forward velocity of the target and on the width of the antenna radiation pattern. Author

N87-27827# Joint Publications Research Service, Arlington, Va.
QUASI-OPTIMUM ALGORITHMS OF RADIO SIGNAL RECEPTION AND PROCESSING WITH INCLUSION OF ANOMALOUS TRACKING MODES Abstract Only c32
M. A. Mironov and M. S. Yalykov *In its* USSR Report: Electronics and Electrical Engineering 6 Aug. 1987 p 31 Transl. into ENGLISH from Radiotekhnika i Elektronika (Moscow, USSR), v. 31, no. 8, Aug. 1986 p 1520-1533 Original language document was announced in IAA as A87-17505 (For primary document see N87-27821 22-31)
Avail: NTIS HC A05/MF A01

Quasi-optimal algorithms for the reception and processing of radio signals with allowance for anomalous tracking regimes are obtained on the basis of the Markov theory of optimal nonlinear filtering using a poly-Gaussian approximation of the a posteriori probability density of the estimated processes. The case of scalar observation, carrying information about a scalar process, is examined in detail. The algorithms are also extended to the case of vector observation and a vector process. IAA

N87-27828# Joint Publications Research Service, Arlington, Va.
OPTIMUM SOLUTIONS AND QUASI-SOLUTIONS TO PROBLEMS OF MICROWAVE HOLOGRAPHY Abstract Only c35
Ye. N. Voronin *In its* USSR Report: Electronics and Electrical

Engineering 6 Aug. 1987 p 52 Transl. into ENGLISH from Radiotekhnika i Elektronika (Moscow, USSR), v. 31, no. 8, Aug. 1986 p 1495-1506 (For primary document see N87-27821 22-31)
Avail: NTIS HC A05/MF A01

Microwave holography is considered, namely recording a microwave field with the aid of multipositional coherent receivers on a hologram and subsequently reconstructing the space-time distribution of active and passive sources constituting the scene. Algorithms are constructed for solving the reconstruction problem optimally with respect to the r.m.s. criterion or with respect to the error functional, in a form applicable to all possible recording modes. Both criteria are in this case very narrow and not necessarily adequate from a practical standpoint such as stability, however, so that a suboptimum solution, quasi-solution or pseudosolution, satisfying an additional constraint such as one on the norm is needed for easy analog-digital processing and prevention of error buildup. Such a quasi-solution is obtained by the variational method, which reduces the problem to minimization of the regularizing functional. In order for this functional to be adequately stabilizing, it is necessary that there be correlation between a specific error and the corresponding processor figure-of-merit with respect to possible variations of the sought space-time signal vector. An algorithm is then constructed accordingly which applies to all possible modes of deterministic and statistical regularization for obtaining pseudosolutions to the general fundamental algebraic operator equation of hologram reconstruction. Author

N87-27829# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
USE OF A SABOT PROJECTILE IN STRUCTURALLY PRE-DESIGNED GUNS M.S. Thesis - 12 Mar. 1986 [UTILIZACAO DE PROJETIS SABOT EM ARMAS PRE-DIMENSIONADAS ESTRUTURALMENTE]
Luciano FigueirasdaSilva Feb. 1987 99 p In PORTUGUESE; ENGLISH summary
(INPE-4109-TDL/261) Avail: NTIS HC A05/MF A01

The implications of the use of a SABOT projectile in guns which were designed for a different type of projectile are analyzed. As the prime application of the SABOT ammunition is linked to short ranges, special attention is given to horizontal trajectories thereby establishing velocity, kinetic energy, and flight time equations assuming a constant drag coefficient. To enable a comparison between the kinetic energies of the original and the SABOT sounds, a gain function is defined relating those energies. Moreover, a method for determining the aerodynamic and stability coefficients and a computer program for preliminary design are presented. Finally, four combinations of materials are studied for prototypes, using plastic or aluminum for the SABOT and uranium or tungsten for the projectile. Author

32 COMMUNICATIONS AND RADAR

Includes radar; land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Space Communications, Spacecraft Communications, Command and Tracking.* For search and rescue see *03 Air Transportation and Safety,* and *16 Space Transportation.*

N87-27830*# Massachusetts Univ., Amherst. Dept. of Electrical and Computer Engineering.
NEAR MILLIMETER WAVE IMAGING/MULTI-BEAM INTEGRATED ANTENNAS Final Technical Report, 1 Jun. 1982 - 30 Jun. 1986
K. Sigfrid Yngvesson, Daniel H. Schaubert, Karl D. Stephan, David M. Pozar, T. C. L. Gerhard Sollner, and Peter T. Parrish 1986 42 p
(Grant NAG1-279)
(NASA-CR-180281; NAS 1.26:180281) Avail: NTIS HC A03/MF A01 CSCL 20N

Some preliminary results on a mixer design which is suitable for integration with tapered slot antennas have been obtained and published. This mixer design was tested both in a 4 to 10 GHz model, and (slightly modified) at 94 GHz. The latter utilized the same Hewlett-Packard beam-lead diodes which were used as detector diodes in the linearly tapered slot antennas (LTSA) arrays. These diodes are the most rugged to be found, and generally survive well on the flexible Kapton substrates. The 4 to 10 GHz version of this mixer has less than 6 dB conversion loss over an octave bandwidth. It uses a slot ring in a balanced configuration, and requires the LO to be fed through a separate port. A different design for a mixer which may be integrated with an LTSA antenna element is discussed. This mixer was tested at 38 GHz with the same HP beam-lead diodes, and has less than 10 dB conversion loss. Further work on mixers has emphasized theoretical modeling, using a computer program, which takes into account the effect of excess noise of Schottky-barrier diodes for the first time. Calculated results agree quantitatively with measured results on millimeter wave mixers. F.M.R.

N87-27831*# Systematics General Corp., Sterling, Va.
[REMOTE SENSING FREQUENCY SHARING STUDIES, TASKS 1, 2, 5, AND 6] Final Report
Douglas Boyd and Tom Tillotson Jul. 1986 47 p
(Contract NASw-3973)
(NASA-CR-180366; NAS 1.26:180366) Avail: NTIS HC A03/MF A01 CSCL 20N

The following tasks are discussed: adjacent and harmonic band analysis; analysis of impact of sensor resolution on interference; development of performance criteria, interference criteria, sharing criteria, and coordination criteria; and spectrum engineering for NASA microwave sensor projects. B.G.

N87-27832*# Systematics General Corp., Sterling, Va.
THE USE OF ACTIVE MICROWAVE SENSORS IN SEARCH AND RESCUE OPERATIONS
Tom Tillotson Jul. 1986 40 p
(Contract NASw-3973)
(NASA-CR-180346; NAS 1.26:180346) Avail: NTIS HC A03/MF A01 CSCL 14B

The possibility of utilizing low-orbit active microwave sensors in Search and Rescue (SAR) operations to detect and positionally locate scenes of distress is studied. The use of a scanning type system, i.e., rotating a highly directional antenna as opposed to more complex synthetic aperture type system is addressed. Targets for this system will be passive reflectors, not active transmitters like EPIRBs; reflectors which could be easily stowed, require little to no maintenance, could be quickly erected and can be more affordable than battery powered alternatives. Presented are parametric analyses to determine the required antenna gains and reflector areas for various frequencies and orbit altitudes. Also, major issues are raised as well as indicating areas requiring further study. Author

N87-27833*# Systematics General Corp., Sterling, Va.
ANALYSIS OF INTERFERENCE TO REMOTE PASSIVE MICROWAVE SENSORS Final Report
Douglas Boyd and Tom Tillotson Jul. 1986 86 p
(Contract NASw-3973)
(NASA-CR-180362; NAS 1.26:180362) Avail: NTIS HC A05/MF A01 CSCL 20N

The final acts of the 1979 World Administrative Radio Conference (WARC) were analyzed to determine potential interference to remote passive microwave sensors. Using interferer populations determined from the U.S. Government and FCC Master File Lists and assuming uniform geographical distribution of interferers, the level of interference from shared services and active services in adjacent and subharmonic bands was calculated for each of the 22 passive sensing bands. In addition, due to the theoretically large antennas required for passive sensing, an analysis was performed to determine if smaller antennas, i.e., relaxed resolution requirements, would have an effect on interference and to what extent. Author

N87-27834# California Univ., Berkeley. Dept. of Computer Sciences.
A PROTOCOL FOR SECURE COMMUNICATION IN LARGE DISTRIBUTED SYSTEMS Technical Report, 7 Aug. 1984 - 6 Aug. 1987
D. P. Anderson, D. Ferrari, P. V. Rangan, and B. Sartirana Jan. 1987 26 p Prepared in cooperation with International Business Machines, Inc., Armonk, N.Y., Olivetti (C.) and C., S.p.A., Turin, Italy and Centro Studie e Laboratori Telecomunicazioni, Tuurin, Italy
(Contract N00039-84-C-0089; ARPA Order 4871)
(AD-A179326) Avail: NTIS HC A03/MF A01 CSCL 09B

A mechanism for secure communication in large distributed systems is proposed. The mechanism, called Authenticated Datagram Protocol (ADP), provides message authentication and, optionally, privacy of data. ADP is a host-to-host datagram protocol, positioned below the transport layer; it uses public-key encryption to establish secure channels between hosts and to authenticate owners, and single-key encryption for communication over a channel and to ensure privacy of the messages. ADP is shown to satisfy the main security requirements of large distributed systems, to provide end-to-end security in spite of its relatively low level, and to exhibit several advantages over schemes in which security mechanisms are at a higher level. The results of a trace-driven measurement study of ADP performance show that its throughput and latency are acceptable even within the limitations of today's technology, provided single-key encryption/decryption can be done in hardware. GRA

N87-27835*# College of William and Mary, Williamsburg, Va. Dept. of Computer Science.
COMMAND/RESPONSE PROTOCOLS AND CONCURRENT SOFTWARE Final Report
W. L. Bynum 24 Jun. 1987 25 p
(Grant NAG1-670)
(NASA-CR-181056; NAS 1.26:181056) Avail: NTIS HC A02/MF A01 CSCL 17B

A version of the program to control the parallel jaw gripper is documented. The parallel jaw end-effector hardware and the Intel 8031 processor that is used to control the end-effector are briefly described. A general overview of the controller program is given and a complete description of the program's structure and design are contained. There are three appendices: a memory map of the on-chip RAM, a cross-reference listing of the self-scheduling routines, and a summary of the top-level and monitor commands. B.G.

N87-27836# Manchester Univ. (England). Dept. of Pure and Applied Physics.
STUDIES OF ELECTRO-OPTICAL ATTENUATION IN THE VICINITY OF CLOUD BASE Final Technical Report, 1 Jun. 1985 - 30 May 1986
John Latham Feb. 1987 111 p
(Grant AF-AFOSR-0229-85)
(AD-A181570; EOARD-TR-87-4) Avail: NTIS HC A06/MF A01 CSCL 20F

Data report of 1986 cloud measurements of cap cloud on Great Dun Fell. PMS FSS probe measurements of particle size distributions from 0.5 to 47 micron radius. Barnes transmissiometer measurements of cloud extinction in three spectral bands. Theoretical extinction coefficients to be derived from droplet spectra detected by PMS FSS probe. GRA

N87-27837# Illinois Univ., Urbana. Electromagnetics Lab.
PROCEEDINGS OF THE ANTENNA APPLICATIONS SYMPOSIUM HELD IN URBANA, ILLINOIS ON 17-19 SEPTEMBER 1986, VOLUME 2
Daniel T. McGrath Feb. 1987 339 p Symposium held in Urbana, Ill., 17-19 Sep. 1986
(Contract F19628-86-M-0004)
(AD-A181537; RADC-TR-87-10-Vol-2) Avail: NTIS HC A15/MF A01 CSCL 09A

The Proceedings of the 1986 Antenna Applications Symposium is a collection of state-of-the-art papers relating to phased array antennas, multibeam antennas, satellite antennas, microstrip antennas, reflector antennas, HF, VHF, UHF, and various other antennas. For individual titles, see N87-27838 through N87-27852.

N87-27838# Microwave Applications Group, Santa Maria, Calif.
A HIGH POWER PHASED ARRAY ANTENNA FOR SUB-SCALE AERIAL TARGET APPLICATIONS
James DeVries, Kaz Doi, and Fred Lauriente *In* Illinois Univ., Proceedings of the Antenna Applications Symposium held in Urbana, Illinois on 17-19 September 1986, Volume 2 Feb. 1987 p 367-385 (For primary document see N87-27837 22-32)
(AD-P005410) Avail: NTIS HC A15/MF A01 CSCL 09A

The simulation of airborne radars place special requirements on antenna systems used in sub-scale targets. Typical airborne radar antennas are steerable in azimuth and elevation and provide gains on the order of 30 dB. The simulation of these antennas on a sub-scale target has been a difficult task. Low gain non-steerable antennas provide good coverage but suffer from marginal ERP. Gimballed attendant problems of excessive weight, large size and high cost. In an effort to find a practical solution, a limited scan prototype phased array antenna has been developed. The prototype phased array effectively utilizes the available aperture to provide a high gain antenna that is steerable over small angles in azimuth and elevation. The phased array antenna described herein is ideal for this application due to its compact size, light weight, and low cost. GRA

N87-27839*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DESIGN CONSIDERATIONS FOR THE BEAMWAVEGUIDE RETROFIT OF A GROUND ANTENNA STATION
T. Veruttipong, J. Withington, V. Galindo-Israel, W. Imbriale, and D. Bathker *In* Illinois Univ., Proceedings of the Antenna Applications Symposium held in Urbana, Illinois on 17-19 September 1986, Volume 2 Feb. 1987 p 387-410 (For primary document see N87-27837 22-32)
(AD-P005411) Avail: NTIS HC A15/MF A01 CSCL 09A

A primary requirement of the NASA Deep Space Network (DSN) is to provide for optimal reception of very low signal levels. This requirement necessitates optimizing the antenna gain to the total system operating noise level quotient. Low overall system noise levels of 16 to 20 K are achieved by using cryogenically cooled preamplifiers closely coupled with an appropriately balanced antenna gain/spillover design. Additionally, high-power transmitters (up to 400 kW CW) are required for spacecraft emergency command and planetary radar experiments. The frequency bands allocated for deep space telemetry are narrow bands near 2.1 and 2.3 GHz (Ka-band), 7.1 and 8.4 GHz (X-band), and 32 and 34.5 GHz (Ka-band). In addition, planned operations for the Search for Extraterrestrial Intelligence (SETI) program require continuous low-noise receive coverage over the 1 to 10 GHz band. To summarize, DSN antennas must operate efficiently with low receive noise and high-power uplink over the 1 to 35 GHz band. GRA

N87-27840# GTE Government Systems Corp., Mountain View, Calif.
AN INEXPENSIVE RELATIVELY BROADBAND MULTI-PURPOSE ANTENNA
Samuel C. Kuo and Warren M. Shelton *In* Illinois Univ., Proceedings of the Antenna Applications Symposium held in Urbana, Illinois on 17-19 September 1986, Volume 2 Feb. 1987 p 411-424 (For primary document see N87-27837 22-32)
(AD-P005412) Avail: NTIS HC A15/MF A01 CSCL 09A

The one-wavelength loop antenna has been widely used in the HF and low VHF range by amateur radio operators in the form of the Quad antenna ever since it was introduced in the late 1940's by Moore. GRA

N87-27841# Hughes Aircraft Co., El Segundo, Calif. Technology Div.
A LOG-PERIODIC ARRAY OF MONOPOLE-SLOT ELEMENTS
David J. Tammen and Paul E. Mayes *In* Illinois Univ., Proceedings of the Antenna Applications Symposium held in Urbana, Illinois on 17-19 September 1986, Volume 2 Feb. 1987 p 425-455 (For primary document see N87-27837 22-32)
(AD-P005413) Avail: NTIS HC A15/MF A01 CSCL 09A

In feeding a log-periodic monopole or slot array, excess line must be used between radiating elements to achieve proper phasing for backfire radiation. Discontinuities presented by the radiating elements, which are approximately one-half wavelength apart on a series feedline, cause additive reflections on the line. There is, therefore, a region on the log-periodic array which behaves similarly to a periodically loaded transmission line operating in a stopband. Reflections occurring in this region inhibit propagation of energy down the feedline. To obtain a frequency-stable impedance, these structural stopband regions should be reduced. One technique that can be used to minimize the stopband region on a series feedline is to reduce the reactive nature of the non-radiating elments using the principle of complementarity. A two-port monopole-slot antenna has been previously shown to have a relatively constant image impedance below its first resonance. GRA

N87-27842# Raytheon Co., Goleta, Calif. Electromagnetic Systems Div.
A SHALLOW-CAVITY UNITY GAIN NOTCH RADIATOR
George J. Monser *In* Illinois Univ., Proceedings of the Antenna Applications Symposium held in Urbana, Illinois on 17-19 September 1986, Volume 2 Feb. 1987 p 457-468 (For primary document see N87-27837 22-32)
(AD-P005414) Avail: NTIS HC A15/MF A01 CSCL 09A

This paper describes a shallow-cavity (0.080 wavelengths deep) notch radiating element with a peak gain of unity, operable over greater than one octave in bandwidth. Based upon three different size antennas excellent pattern characteristics were measured over a 3/1 frequency band when flush-mounted in a small ground plane. GRA

N87-27843# American Electronic Labs., Inc., Lansdale, Pa.
ULTRA-BROADBAND IMPEDANCE MATCHING USING ELECTRIC ALLY SMALL SELF-COMPLEMENTARY STRUCTURES
K. G. Schroeder *In* Illinois Univ., Proceedings of the Antenna Applications Symposium held in Urbana, Illinois on 17-19 September 1986, Volume 2 Feb. 1987 p 469-490 (For primary document see N87-27837 22-32)
(AD-P005415) Avail: NTIS HC A15/MF A01 CSCL 09A

A number of self-complementary structures are investigated with the goal of providing frequency-independent matching of the inductive reactance of the other element. Impedance bandwidths of up to 50:1 are found to be achievable with very small (H approximately 0.006 lambda) element heights. Efficiencies are determined by achievable loss resistances in the radiating structure itself, rather than the (limited) quality of an external loading coil, and by energy channeled into the difference port of the feed hybrid, which is used to match two complementary impedances. GRA

N87-27844# American Electronic Labs., Inc., Lansdale, Pa.
IMPEDANCE-INVERTING FEED DESIGNS FOR BROADBAND ENDFIRE COMPLEMENTARY PAIRS USING THIN WIRE ELEMENTS
K. G. Schroeder *In* Illinois Univ., Proceedings of the Antenna Applications Symposium held in Urbana, Illinois on 17-19 September 1986, Volume 2 Feb. 1987 p 491-519 (For primary document see N87-27837 22-32)
(AD-P005416) Avail: NTIS HC A15/MF A01 CSCL 09A

Broadband impedance matching of externally complementarized endfire monopole pairs is described, where the radiating elements consist of thin wires. Broadband impedance loci are achieved for the thin radiators by impedance inverters placed prior to the complementarizing circuit. Impedance matching is then accomplished in a standard broadband hybrid or Magic Tee. GRA

N87-27845# Council for Scientific and Industrial Research, Pretoria (South Africa).
PATTERN PREDICTION OF BROADBAND MONOPOLE ANTENNAS ON FINITE GROUNDPLANES USING THE BOR MOMENT METHOD
Dirk E. Baker and Louis Botha *In* Illinois Univ., Proceedings of the Antenna Applications Symposium held in Urbana, Illinois on 17-19 September 1986, Volume 2 Feb. 1987 p 521-546 (For primary document see N87-27837 22-32)
(AD-P005417) Avail: NTIS HC A15/MF A01 CSCL 09A

This paper describes the design and measured performance of very thick cylindrical monopole antennas (length-to-diameter ratios about 2). These very thick monopole antennas exploit the physical dimensions of common coaxial connectors to achieve 3:1 frequency bandwidths with VSWR less than 2:1 in the 2 to 20 GHz frequency range. The antenna patterns of the very thick monopole antennas differ significantly from those of their thin counterparts. The body of revolution moment method technique is used to predict the E-plane patterns of the very thick cylindrical monopoles as those of conical monopoles at the center of finite circular groundplanes. Agreement between measured and predicted patterns is excellent. GRA

N87-27846# Watkins-Johnson Co., Palo Alto, Calif.
POLARIZATION MEASUREMENT
David L. Hawthorne *In* Illinois Univ., Proceedings of the Antenna Applications Symposium held in Urbana, Illinois on 17-19 September 1986, Volume 2 Feb. 1987 p 547-580 (For primary document see N87-27837 22-32)
(AD-P005418) Avail: NTIS HC A15/MF A01 CSCL 14B

Potential applications for a precision, monopulse polarimeter exist in many areas, from ELINT to communications. Many applications require coverage of a broad range of frequencies, rapid processing, and the ability to present measurement results to both human operators and other digital systems. In addition, the form in which measurement results are presented must often be modified to suit a particular application. The need for a powerful, flexible, monopulse polarimeter prompted the development of the Watkins-Johnson Company polarization measurement system. GRA

N87-27847# Scientific-Atlanta, Inc., Atlanta, Ga.
REVIEW OF SPHERICAL NEAR-FIELD MEASUREMENTS
Doren W. Hess *In* Illinois Univ., Proceedings of the Antenna Applications Symposium held in Urbana, Illinois on 17-19 September 1986, Volume 2 Feb. 1987 p 581-596 (For primary document see N87-27837 22-32)
(AD-P005419) Avail: NTIS HC A15/MF A01 CSCL 14B

Over the past decade spherical near-field measurements have made the transition from research to application. Based upon spherical modal expansion and a port-to-port transmission equation, the spherical near-field technique utilizes sophisticated mathematical processing to solve the practical problem of obtaining antenna pattern measurements in a confined space. Conventional hardware--consisting of rotary test positioners, signal sources and receivers augmented by digital control electronics and minicomputers--now makes spherical near-field measurements practical by automation. Recent developments in spherical near-field software architecture have expanded the basic scanning feature to include dual-port scanning, probe pattern and probe polarization correction, three antenna polarization measurements, gain comparison measurements and correction for thermal drift of the system. GRA

N87-27848*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SWEPT FREQUENCY TECHNIQUE FOR DISPERSION MEASUREMENT OF MICROSTRIP LINES
Richard Q. Lee *In* Illinois Univ., Proceedings of the Antenna

Applications Symposium held in Urbana, Illinois on 17-19 September 1986, Volume 2 Feb. 1987 p 597-614 (For primary document see N87-27837 22-32)
(AD-P005420) Avail: NTIS HC A15/MF A01 CSCL 14B

Microstrip lines used in microwave integrated circuits are dispersive. Because a microstrip line is an open structure, the dispersion can not be derived with pure TEM, TE, or TM mode analysis. Dispersion analysis has commonly been done using a spectral domain approach, and dispersion measurement has been made with high Q microstrip ring resonators. Since the dispersion of a microstrip line is fully characterized by the frequency dependent phase velocity of the line, dispersion measurement of microstrip lines requires the measurement of the line wavelength as a function of frequency. In this paper, a swept frequency technique for dispersion measurement is described. GRA

N87-27849# Council for Scientific and Industrial Research, Pretoria (South Africa).
EVALUATION OF LOCALIZED INHOMOGENEITIES IN THE REFLECTIVITY OF PLANAR ABSORBER PANELS
Dirk E. Baker and Cornelis A. VanDerNeut *In* Illinois Univ., Proceedings of the Antenna Applications Symposium held in Urbana, Illinois on 17-19 September 1986, Volume 2 Feb. 1987 p 615-629 (For primary document see N87-27837 22-32)
(AD-P005421) Avail: NTIS HC A15/MF A01 CSCL 20N

For certain applications the antenna designer may require a knowledge of the small scale, or localed, reflectivity properties of microwave absorbers. Suppliers of microwave absorbers generally quote the average absorption achieved over fairly large panels (610 mm x 610 mm) as determined by one of several free-space measurement techniques. By the nature of their construction, small samples of planar absorber panels cannot generally be evaluated directly in waveguide, particularly at X-band and above. GRA

N87-27850# Illinois Univ., Chicago. Dept. of Electrical Engineering and Computer Science.
RESULTS OF OPTIMIZATION OF YAGI-UDA ARRAYS OF SHAPED DIPOLES
Stephen D. Hibbard, Sharad R. Laxpati, and Paul D. Wolfe *In its* Proceedings of the Antenna Applications Symposium held in Urbana, Illinois on 17-19 September 1986, Volume 2 Feb. 1987 p 631-653 (For primary document see N87-27837 22-32)
(AD-P005422) Avail: NTIS HC A15/MF A01 CSCL 09A

The method for maximization of the directivity of Yagi-Uda arrays of shaped dipoles as outlined by Liang and Cheng was employed to optimize a three-element array of shaped dipoles, each 1.5 wavelengths in length and 0.01 wavelengths in radius. Liang and Cheng's optimal three element array was confirmed to yield a maximum directivity of 11.8 dB using the moment method with second-order expansions as formulated by Harrington. Two simplex minimization routines were alternately used to independently determine optimal element shapes and eliminate saddle points for a three-element array of the same dipole lengths and radii, 1.5 and 0.01 wavelengths, respectively. Using this procedure, a shaped-dipole Yagi-Uda array different from Liang and Cheng's example was found to yield a maximum directivity of 12.6 dB. GRA

N87-27851# Council for Scientific and Industrial Research, Pretoria (South Africa).
RESULTS OF NUMERICAL AND PHYSICAL MODELLING OF AIRBORNE ADCOCK ARRAYS FOR VHF DF (DIRECTION FINDING) APPLICATIONS
D. C. Baker, L. Botha, D. A. McNamara, and G. W. Reed *In* Illinois Univ., Proceedings of the Antenna Applications Symposium held in Urbana, Illinois on 17-19 September 1986, Volume 2 Feb. 1987 p 655-685 (For primary document see N87-27837 22-32)
(AD-P005423) Avail: NTIS HC A15/MF A01 CSCL 17C

This paper describes an attempt to predict the received voltages on a VHF direction finding (DF) array using the geometrical theory of diffraction and the principle of reciprocity. Once the received voltages are known bearing errors can be predicted from the phase information. The predicted receive mode radiation patterns are compared with a simple model of a C130 Hercules transport aircraft. Further comparison is made with models representing a low-wing jetliner with underwing engines. The latter aircraft models use either a blunt capped cylinder or a sectional cylinder with a emispherical cap and a conic section. The comparison between predicted and measured results are reasonable. GRA

N87-27852# TRW Energy Systems Group, Redondo Beach, Calif.
MATRIX FORMULATION OF VECTOR OPERATIONS IN ELECTROMAGNETICS ANALYSIS
Feng C. Chang *In* Illinois Univ., Proceedings of the Antenna Applications Symposium held in Urbana, Illinois on 17-19 September 1986, Volume 2 Feb. 1987 p 687-698 (For primary document see N87-27837 22-32)
(AD-P005424) Avail: NTIS HC A15/MF A01 CSCL 12B

The manipulation of vector quantities is unavoidable in the study of electromagnetic fields. An efficient technique is developed to simplify the evaluation of vector algebraic and differential operations by simply converting the vector operations into matrix operations. This matrix formulation is especially useful when there are mixed coordinate basis involved in the vector operations. Application to some antenna analysis problems will demonstrate the merit of the technique presented. GRA

N87-27853 Connecticut Univ., Storrs.
RANDOM ACCESS ALGORITHMS IN MULTI-USER COMMUNICATION SYSTEMS FOR SPREAD SPECTRUM AND NON-SPREAD-SPECTRUM ENVIRONMENTS Ph.D. Thesis
Michael George Georgiopoulos 1986 158 p
Avail: Univ. Microfilms Order No. DA8709030

We initially propose and analyze an efficient algorithm for the random accessing of a broadcast channel by a large number of packet-transmitting, bursty users. The algorithm uses a mini-slot overhead, per packet, to extract detailed information regarding packet collisions in order to accelerate the collision resolution process. The maximum stable throughput and the mean packet delay induced by the algorithm are evaluated via a systematic analysis method. Then, we propose and analyze an asynchronous limited sensing random access algorithm for a collision-type packet-switched channel in a local area environment, where carrier sensing techniques are possible due to small propagation delays. Utilizing the regenerative structure of the stochastic processes that are associated with the random access system, we derive lower bounds on the induced mean packet delay. Finally, we propose and analyze limited sensing random access algorithms for multi-user and multi-receiver direct sequence and frequency-hopping spread-spectrum systems. Utilizing the regenerative character of output process as induced by the algorithm, we compute throughputs subject to an upper bound on the probability of erroneous data decoding; we also compute the expected per packet delays. Dissert. Abstr.

N87-27854# European Space Agency, Paris (France).
PROCEEDINGS OF THE SAR APPLICATIONS WORKSHOP
T. D. Guyenne, comp. and J. J. Hunt, comp. Dec. 1986 123 p Workshop held in Frascati, Italy, 16-18 Sep. 1986
(ESA-SP-264; ISSN-079-6566; ETN-87-90156) Copyright Avail: NTIS HC A06/MF A01

Active microwave observations of sea ice and icebergs; the potential of SAR in a snow and glacier monitoring system; simulation of SAR data products; SAR detection of ships and ship wakes; line detection in SAR images; geological feature enhancement in SAR imagery; use of SAR data for agriculture and forestry; land use feature detection in SAR images; an algorithm for automatically acquiring ground control points in SAR imagery; and SAR instrument studies were discussed. For individual titles, see N87-27855 through N87-27865.

N87-27855# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
ACTIVE MICROWAVE OBSERVATIONS OF SEA ICE AND ICEBERGS

H. Skriver, P. Gudmandsen, and L. Ulander (Chalmers Univ. of Technology, Goeteborg, Sweden) *In* ESA Proceedings of the SAR Applications Workshop Dec. 1986 p 13-24 (For primary document see N87-27854 22-32)
Copyright Avail: NTIS HC A06/MF A01

Methods of automatic retrieval of sea ice parameters from SAR and radar altimeters were investigated. For classification of ice types and for reidentification of floes in consecutive SAR images, texture measures were assessed. Statistical measures, measures of contrast and homogeneity, and co-occurrence matrix measures were studied. For classification the most simple measure, the ratio between the standard deviation and the mean performs best. Texture measures are correlated. For reidentification of floes the performance of the measures is modest, and more advanced methods must be developed. Parameter retrieval from radar altimeter data based on a model of the backscattering mechanisms was investigated, and consistency is found from a comparison between a Seasat SAR scene and overlapping altimeter data. The capability of a spaceborne SAR to detect icebergs was evaluated. ESA

N87-27856# Innsbruck Univ. (Austria). Inst. fuer Meteorologie und Geophysik.
THE POTENTIAL OF SAR IN A SNOW AND GLACIER MONITORING SYSTEM
H. Rott, C. Maetzer, and D. Strobl (Technische Univ., Graz, Austria) *In* ESA Proceedings of the SAR Applications Workshop Dec. 1986 p 25-35 (For primary document see N87-27854 22-32)
Copyright Avail: NTIS HC A06/MF A01

The use of SAR for snow and glacier applications as part of a multisensor land application system is investigated. Results on the physical properties and the signatures of backscattering of snow and ice are presented. The capabilities of sensors in the various spectral regions are compared. A synergistic data set was analyzed using rectified airborne SAR and LANDSAT TM data. Investigations with additional data sets are going on for optimum use of SAR in an advanced Earth observation system. ESA

N87-27857# Marconi Co. Ltd., Chelmsford (England).
THE SIMULATION OF SAR DATA PRODUCTS
S. Quegan, J. M. Lamont, R. J. Miller, P. J. Meadows, A. Wright, N. J. Veck, P. N. Churchill, G. Holmes, J. W. Trevett, and D. Sloggett (Software Sciences Ltd., Farnborough, England) et al. *In* ESA Proceedings of the SAR Applications Workshop Dec. 1986 p 37-45 (For primary document see N87-27854 22-32)
Copyright Avail: NTIS HC A06/MF A01

Conditions a SAR simulator must meet for agriculture and forestry are presented. Several levels of simulation are identified, each requiring particular software tools; the feasibility of producing these tools is discussed. The major requirement is for a radar cross section database whose input data is comprehensively described and of known accuracy; experimental conditions must, in principle, be repeatable from the measurement description and the database must be linked to thoroughly understood theoretical models. The random medium, lossy scatterer, and water cloud models are shown to have a similar structure, allowing comparability, but Peake's (1959) model for cereals and grasses has a different form. A prototype database was constructed. Also important is texture simulation; methods based on the autocorrelation function and the spatial gray level dependency matrix are described. Examples of simulation of textured regions and linear features are displayed. ESA

N87-27858# Stuttgart Univ. (West Germany).
SIMULATION OF SYNTHETIC APERTURE RADAR DATA PRODUCTS
Ph. Hartl, M. J. Nahvi, S. Rieger, W. Wiesbeck, M. S. Scivier, D. G. Corr, and A. J. Sieber (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen, West Germany) *In* ESA Proceedings of the SAR Applications Workshop Dec. 1986 p 47-59 (For primary document see N87-27854 22-32)
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Gaps in radar cross section (RCS) data are identified and desired features of a short and long term data base are summarized. The need for coherent RCS is discussed and is exemplified by laboratory measurements for needles and twigs. A measurement program including simultaneous use of laser ranging and RCS measurements in the laboratory and field is recommended. The end-to-end SAR product simulation is constructed. Generic types of simulators are presented. Simulation of speckle and texture is discussed. ESA

N87-27859# Norwegian Defence Research Establishment, Kjeller.
SAR DETECTION OF SHIPS AND SHIP WAKES
T. Wahl, K. Eldhuset, and K. Aksnes *In* ESA Proceedings of the SAR Applications Workshop Dec. 1986 p 61-65 (For primary document see N87-27854 22-32)
Copyright Avail: NTIS HC A06/MF A01

Over 200 SAR images of ship wakes were analyzed. Digital techniques for wake detection and analysis are described. Detection of ships and ship wakes from orbiting SAR seems feasible under a wide range of environmental conditions. The state of wake modeling is not sufficient to utilize all the ship information hidden in the wake, although speed and direction of motion can be determined quite straightforwardly. ESA

N87-27860# Marconi Co. Ltd., Chelmsford (England).
THIN LINE DETECTION IN SAR IMAGES Abstract Only
J. Skingley and S. Quegan *In* ESA Proceedings of the SAR Applications Workshop Dec. 1986 p 67-68 Sponsored by the RAE, Farnborough, England, and the Royal Signals and Radar Establishment (For primary document see N87-27854 22-32)
Copyright Avail: NTIS HC A06/MF A01

The use of local operators (masks), global transforms, and dynamic programming to detect thin lines in SAR images is summarized. Relevance to ship wake detection, SAR data simulation (from the investigation of the nature of thin lines in SAR imagery), and land use feature extraction from SAR images is mentioned. ESA

N87-27861# Lund Univ. (Sweden).
GEOLOGICAL FEATURE ENHANCEMENT IN SAR IMAGERY
P. Ulriksen and C. Svensson *In* ESA Proceedings of the SAR Applications Workshop Dec. 1986 p 69-79 (For primary document see N87-27854 22-32)
(Contract ESA-6692/86-F-FL(SC))
Copyright Avail: NTIS HC A06/MF A01

Image enhancement techniques, geological screening of SAR imagery to find test sites, and results from test runs on an image analysis system built to analyze texture are summarized. Work needed on speckle smoothing, shape from shading, human visual response, edge detection, sharpness of magnified images, and computerized classification is discussed. ESA

N87-27862# Digim (1983), Inc. Montreal (Quebec).
STUDY ON THE USE OF SAR DATA FOR AGRICULTURE AND FORESTRY
G. Rochon, C. Gosselin, M. Rheault, P. Vincent, K. P. B. Thomson, B. GozeBertin, S. Poirier, and F. Cavayas *In* ESA Proceedings of the SAR Applications Workshop Dec. 1986 p 81-93 Prepared in cooperation with Laval Univ., Quebec and Montreal Univ., Quebec (For primary document see N87-27854 22-32)
Copyright Avail: NTIS HC A06/MF A01

Modeling of radar backscatter from vegetation canopies using existing ground measurements; processing techniques required to facilitate information extraction from noisy SAR data; and the increase in information content brought about by the integration of optical data with SAR data are considered with respect to agriculture and the forestry applications of ERS-1 (ESA satellite). Lack of data on ground parameters and on the geometrical configuration of the SAR system restricts conclusions, but the potential of ERS-1 in agricultural applications is confirmed. ESA

N87-27863# Hunting Geology and Geophysics Ltd., Boreham Wood (England).
LAND USE FEATURE DETECTION IN SAR IMAGES
G. C. Deane, S. Quegan, P. N. Churchill, A. Hendry (Marconi Co. Ltd., Chelmsford, England), R. Evans, and J. W. Trevett *In* ESA Proceedings of the SAR Applications Workshop Dec. 1986 p 95-102 (For primary document see N87-27854 22-32)
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Segmentation, speckle reduction, and feature detection techniques for automatic interpretation of SAR images are discussed. A quantitative approach for assessing their performance is described. A method for comparing algorithms using filtering followed by edge-detection followed by bonding was developed. Using this method to optimize an algorithm based on the Frost filter suggests that the Frost filter is better replaced by the mean filter. Work on feature detection using correlation led to a method for comparing correlations. It is shown that the mean-square correlator is of no use in the presence of Rayleigh speckle. ESA

N87-27864# Ball (Roy) Associates Ltd., Ottawa (Ontario).
AN ALGORITHM FOR AUTOMATICALLY ACQUIRING GROUND CONTROL POINTS IN SAR IMAGERY
J. Weiler, M. Brule, K. Lim, R. Ball, and T. Turner (Gregory Geoscience Ltd., Ottawa, Ontario) *In* ESA Proceedings of the SAR Applications Workshop Dec. 1986 p 103-110 (For primary document see N87-27854 22-32)
Copyright Avail: NTIS HC A06/MF A01

Research into fully automated techniques for acquiring ground control points (GCPs) in SAR imagery is presented. An algorithm whose performance in acquiring GCPs in test imagery is comparable to that of a human operator is described. ESA

N87-27865# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
SUMMARY OF RECENT SAR INSTRUMENT STUDIES
D. R. Janssen *In its* Proceedings of the SAR Applications Workshop Dec. 1986 p 111-119 (For primary document see N87-27854 22-32)
Copyright Avail: NTIS HC A06/MF A01

Synthetic aperture radar SAR swath widening techniques were studied. Advanced SAR instruments were designed to cover at altitudes up to 900 km incidence angular ranges between 20 and 45 deg providing high image quality with dual frequency or twin SAR's. Broadside looking instruments with dual beam capability are favored. An instrument was sized to fit on the Columbus Polar Platform, which required a reduction of image quality and had to be limited to C-band. Detailed SAR instrument definition is in progress to introduce digital techniques for pulse expansion/compression, and to provide antenna designs with dual beam capability with an optimum technology. ESA

N87-27866# Ewbank Preece Consulting Ltd., Brighton (England).
A STUDY OF FREQUENCY ALLOCATION PROBLEMS IN THE LAND MOBILE SATELLITE SERVICE
Paris, France ESA Jun. 1986 109 p
(Contract ESA-1787/85-F-RD)
(ESA-CR(P)-2331; ETN-87-99883) Avail: NTIS HC A06/MF A01

The market for land mobile satellite services (LMS) in Europe was assessed to evaluate frequency requirements. In the context that the highest traffic prediction for the year 1995 is equivalent to 21,000 erlangs of traffic in the busy hour, it is unlikely that, even with the use of highly sophisticated techniques for frequency reuse, and bandwidth compression, this traffic could be accommodated in less than 140MHz of frequency spectrum (70MHz both up and down). The frequency bands 1515 to 1559MHz and 1646.5 to 1660.5MHz should be shared between the LMS and the aeronautical mobile satellite service, the sharing criteria to be agreed between the parties concerned. The frequency bands 2500 to 2520MHz and 2600 to 2620MHz should be reassigned to include the LMS on a primary basis. ESA

N87-27867# European Space Agency, Paris (France).
PACKET VOICE COMMUNICATION
Peter Noll, Volker Leesemann, and Guenter Wessels Feb. 1987 248 p Transl. into ENGLISH of "Paketorientierte Sprachuebertragung, Cologne, West Germany Original language document was announced as N86-32623. Original document was prepared by Berlin Technical Univ., West Germany
(ESA-TT-1006; DFVLR-Mitt-86-05; ETN-87-90009) Avail: NTIS HC A11/MF A01; original German version available from DFVLR, Cologne, West Germany DM 59

The problems of transmitting packetized voice signals are reviewed and the distortions resulting from digitization, speech detection, channel errors, and constant and stochastic transmission delays are analyzed. Measures to overcome distortions, and progress and goals in experimental networks which include satellite-based experiments are discussed. ESA

N87-27868# European Space Agency, Paris (France).
ERROR ANALYSIS OF SAR HARDWARE
Joao Roberto Moreira Mar. 1987 97 p Transl. into ENGLISH of "Fehleranalyse von SAR-Hardware, Oberpfaffenhofen, West Germany Original language document was announced as N87-14591
(ESA-TT-1024; DFVLR-FB-86-26; ETN-87-90017) Avail: NTIS HC A05/MF A01; original German version available from DFVLR, Cologne, West Germany DM 26.50

For the error analysis of radar flash A/D-converters a computer aided measurement procedure which evaluates their dynamic characteristics was designed. Results like the transfer function, signal-to-noise ratio, jitter, linearity errors, and dispersion of two 100 MHz A/D-converters were obtained. This measurement principle permits the calibration of the front-end and the video section of the SAR, where the A/D-converters are considered as a measuring instrument. ESA

N87-27869*# Ohio State Univ., Columbus. ElectroScience Lab.
ANALYSIS OF AIRBORNE ANTENNA SYSTEMS USING GEOMETRICAL THEORY OF DIFFRACTION AND MOMENT METHOD COMPUTER CODES
Richard G. Hartenstein, Jr. Aug. 1985 76 p
(Grant NsG-1498)
(NASA-CR-181248; NAS 1.26:181248; Rept-716199-6) Avail: NTIS HC A05/MF A01 CSCL 20N

Computer codes have been developed to analyze antennas on aircraft and in the presence of scatterers. The purpose of this study is to use these codes to develop accurate computer models of various aircraft and antenna systems. The antenna systems analyzed are a P-3B L-Band antenna, an A-7E UHF relay pod antenna, and traffic advisory antenna system installed on a Bell Long Ranger helicopter. Computer results are compared to measured ones with good agreement. These codes can be used in the design stage of an antenna system to determine the optimum antenna location and save valuable time and costly flight hours. Author

N87-27870*# Ohio State Univ., Columbus. ElectroScience Lab.
SIMULATION AND ANALYSIS OF AIRBORNE ANTENNA RADIATION PATTERNS
J. J. Kim and Walter D. Burnside Dec. 1984 345 p
(Grant NsG-1498)
(NASA-CR-181250; NAS 1.26:181250; Rept-716199-1) Avail: NTIS HC A15/MF A01 CSCL 20N

The objective is to develop an accurate and efficient analytic solution for predicting high frequency radiation patterns of fuselage-mounted airborne antennas. This is an analytic study of airborne antenna patterns using the Uniform Geometrical Theory of Diffraction (UTD). The aircraft is modeled in its most basic form so that the solution is applicable to general-type aircraft. The fuselage is modeled as a perfectly conducting composite ellipsoid; whereas, the wings, stabilizers, nose, fuel tanks, and engines, are simulated as perfectly conducting flat plates that can be attached to the fuselage and/or to each other. The composite-ellipsoid fuselage model is necessary to successfully

simulate the wide variety of real world fuselage shapes. Since the antenna is mounted on the fuselage, it has a dominant effect on the resulting radiation pattern so it must be simulated accurately, especially near the antenna. Various radiation patterns are calculated for commercial, private, and military aircraft, and the Space Shuttle Orbiter. The application of this solution to numerous practical airborne antenna problems illustrates its versatility and design capability. In most cases, the solution accuracy is verified by the comparisons between the calculated and measured data.
Author

N87-27871*# Ohio State Univ., Columbus. ElectroScience Lab.
A UNIFORM GTD ANALYSIS OF THE EM DIFFRACTION BY A THIN DIELECTRIC/FERRITE HALF-PLANE AND RELATED CONFIGURATIONS
Roberto G. Rojas Mar. 1985 425 p
(Grant NsG-1498)
(NASA-CR-181251; NAS 1.26:181251; Rept-716199-5) Avail: NTIS HC A18/MF A01 CSCL 20N

A uniform geometrical theory of diffraction (UTD) solution is developed for the problem of the diffraction by a thin dielectric/ferrite half plane when it is excited by a plane, cylindrical, or surface wave field. Both transverse electric and transverse magnetic cases are considered. The solution of this problem is synthesized from the solutions to the related problems of EM diffraction by configurations involving perfectly conducting electric and magnetic walls covered by a dielectric/ferrite half-plane of one half the thickness of the original half-plane. Author

N87-27872*# Ohio State Univ., Columbus. ElectroScience Lab.
A CASSEGRAIN REFLECTOR SYSTEM FOR COMPACT RANGE APPLICATIONS
Mark D. Rader and Walter D. Burnside Jul. 1986 180 p
(Grant NsG-1613)
(NASA-CR-181268; NAS 1.26:181268; Rept-716148-14) Avail: NTIS HC A09/MF A01 CSCL 20N

An integral part of a compact range is the means of providing a uniform plane wave. A Cassegrain reflector system is one alternative for achieving this goal. Theoretically, this system offers better performance than a simple reflector system. The longer pathlengths in the Cassegrain system lead to a more uniform field in the plane of interest. The addition of the subreflector creates several problems, though. System complexity is increased both in terms of construction and performance analysis. The subreflector also leads to aperture blockage and the orientation of the feed now results in spillover illuminating the target areas as well as the rest of the range. Finally, the addition of the subreflector leads to interaction between the two reflectors resulting in undesired field variations in the plane of interest. These difficulties are addressed and through the concept of blending the surfaces, a Cassegrain reflector system is developed that will provide a uniform plane wave that offers superior performance over large target areas for a given size reflector system. Design and analysis is implemented by considering the main reflector and subreflector separately. Then the system may be put together and the final design and system analysis completed. Author

N87-27873*# Ohio State Univ., Columbus. ElectroScience Lab.
ANALYSIS AND MEASUREMENT OF ELECTROMAGNETIC SCATTERING BY PYRAMIDAL AND WEDGE ABSORBERS
B. T. DeWitt and Walter D. Burnside Mar. 1986 238 p
(Grant NsG-1613)
(NASA-CR-181270; NAS 1.26:181270; Rept-716148-10) Avail: NTIS HC A11/MF A01 CSCL 20N

By modifying the reflection coefficients in the Uniform Geometrical Theory of Diffraction a solution that approximates the scattering from a dielectric wedge is found. This solution agrees closely with the exact solution of Rawlins which is only valid for a few minor cases. This modification is then applied to the corner diffraction coefficient and combined with an equivalent current and geometrical optics solutions to model scattering from pyramid and wedge absorbers. Measured results from 12 inch pyramid absorbers from 2 to 18 GHz are compared to calculations assuming the returns add incoherently and assuming the returns add coherently. The measured results tend to be between the two curves. Measured results from the 8 inch wedge absorber are also compared to calculations with the return being dominated by the wedge diffraction. The procedures for measuring and specifying absorber performance are discussed and calibration equations are derived to calculate a reflection coefficient or a reflectivity using a reference sphere. Shaping changes to the present absorber designs are introduced to improve performance based on both high and low frequency analysis. Some prototypes were built and tested.
Author

N87-27874*# Ohio State Univ., Columbus. ElectroScience Lab.
ELECTROMAGNETIC SCATTERING FROM A CLASS OF OPEN-ENDED WAVEGUIDE DISCONTINUITIES
A. Altintas, P. H. Pathak, and Walter D. Burnside Mar. 1986 319 p
(Grant NsG-1613)
(NASA-CR-181271; NAS 1.26:181271; Rept-716148-9) Avail: NTIS HC A14/MF A01 CSCL 20N

A relatively simple high frequency analysis of electromagnetic scattering from a class of open-ended waveguide discontinuites was developed. The waveguides are composed of perfectly-conducting sections in which the electromagnetic field can be written as the sum of waveguide modes. Junctions are formed at the open end and also within interior regions where different sections are joined. The reflection and transmission properties of each junction are described in terms of a scattering matrix which is determined by combining the modal ray picture with high frequency techniques such as the Geometrical Theory of Diffraction (GTD), the Equivalent Current Method (ECM), and modifications of the Physical Theory of Diffraction (PTD). A new set of equivalent circuits are employed in this ECM analysis which leads to a simple treatment of many types of junction discontinuities. Also, a new procedure is presented to improve the efficiency of the aperture integration at the open end which is required in the PTD procedure for finding the fields radiated from (or coupled to) the open end. Once the scattering matrices are determined, they are then combined using a self-consistent multiple scattering method to obtain the total scattered fields. Author

N87-27875# Georgia Inst. of Tech., Atlanta. Fusion Research Center.
THE 5TH INTERNATIONAL EDDY CURRENT WORKSHOP
K. R. Davey Mar. 1987 81 p Workshop held in Atlanta, Ga., 1987
(PB87-185112; GTFR-71) Avail: NTIS HC A05/MF A01 CSCL 20N

The report of the Fifth International Eddy Current Workshop contains the following: Results for problem 6 - hollow sphere; Analytical solutions to problem 6 of the International Electromagnetic Workshops; Calculation of test problem 6 - a hollow conducting sphere in a uniform alternating magnetic field; Sphere in uniform magnetic field (problem 6); Workshop problem 6 (hollow sphere) solved in 1-, 2-, and 4-shell approximation with EDDYNET-2D; Results for eddy current workshop problem No. 2 of the International Electromagnetics Workshop; Analytic solution to problem 6 of the International Electromagnetic Workshops.
GRA

N87-27876# National Telecommunications and Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.
MONITORING OF HARMFUL INTERFERENCE TO THE HF (HIGH FREQUENCY) BROADCASTING SERVICE. 2: RESULTS OF THE JANUARY 1986 COORDINATED MONITORING PERIOD
M. W. Sowers, G. R. Hand, and C. M. Rush Oct. 1986 133 p
Sponsored by Voice of America, Washington, D.C.
(PB87-180212; NTIA-86-206; Rept-2) Avail: NTIS HC A07/MF A01 CSCL 17B

This is the second in a series of reports describing the results of studies to determine the location of sources of harmful interference to the HF broadcasting service. Using observations

recorded during the January 1986 monitoring program conducted by the International Frequency Registration Board, the report describes procedures used to analyze the data; amplifies studies of earlier monitoring programs; identifies frequently observed emitters of harmful interference; and note the extent of such interference to programs of leading international broadcast organizations. GRA

N87-27877# National Telecommunications and Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.
FIBER OPTIC NETWORKS AND THEIR SERVICE SURVIVAL
M. Nesenbergs Mar. 1987 120 p Sponsored by National Communications System, Arlington, Va.
(PB87-186706; NTIA-87-214; NCS-TIB-87-9) Avail: NTIS HC A06/MF A01 CSCL 17B

The objective of the study is to look at fiber optic networks in a predominately functional domain and to assess their potential survivability advantages from that point of view. As a consequence, service survivability is emphasized far more than physical survivability, although physical existence of facilities is a definite prerequisite for all telecommunications services. The need for a quantitative (or formal, or unique, or numerical) definition of the term survivability is addressed. The report proposes a partial solution of this problem. It introduces a network-related quantity, defined with the moments of the connectivity cross section histograms, that appears to possess many of the properties wanted for measuring and comparing survivabilities of different topologies. For lack of a better name, that quantity may be called the effective survivability index. GRA

N87-27878# Washington Univ., Seattle. Dept. of Electrical Engineering.
STABILIZATION OF NONPERSISTENT AND VIRTUAL TIME CSMA USING STOCHASTIC APPROXIMATION
G. A. Cunningham Jun. 1986 121 p
(Grant NSF ECS-84-08240)
(PB87-181475; TR-233; NSF/ENG-86025) Avail: NTIS HC A06/MF A01 CSCL 17B

Nonpersistent and virtual Carrier Sense Multiple Access (CSMA) are proven stable under a Poisson input load using a stochastic approximation stabilization scheme with no knowledge, exact or approximate, of the number of blocked stations. It is not assumed that the number of blocked stations is constant, and the physical parameters of the problem are retained throughout the proof. Simulations are used to verify the stability proof by showing that the actual throughput is within the measurement error of the theoretical maximum, to demonstrate stability for input loads below the maximum, to verify that stability is maintained even with sudden increases in the number of blocked stations, and to gain insight into the delay vs, throughput behavior of nonpersistent and virtual CSMA when using the stochastic approximation stabilization scheme. GRA

N87-27879# Oak Ridge National Lab., Tenn.
EMP COUPLING TO SHIELDED CABLES
D. C. Agouridis 1987 5 p Presented at the 24th Annual Conference on Nuclear and Space Radiation in Electronics, Snowmass, Colo., 28 Jul. 1987
(Contract DE-AC05-84OR-21400)
(DE87-004909; CONF-870724-1) Avail: NTIS HC A02/MF A01

Electromagnetic coupling to shielded cables is analyzed in terms of two electromagnetically coupled transmission lines excited by distributed sources. This analysis results in two traveling waves on the shield and four traveling waves in the core of the cable. Transient waveforms are reported from EMP coupling on an overhead RG-58 cable. DOE

N87-27880# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
ERROR SENSITIVITY OF COMPRESSED IMAGE DATA ON SATELLITE COMMUNICATION LINKS
H. J. Simons 26 Mar. 1986 14 p Presented at the 7th Symposium on Information Theory in the Benelux, Noordwijkerhout, The Netherlands, 22-23 May 1986
(Contract ESTEC-6235/85-NL-JS)
(NLR-MP-86022-U; B8701674; ETN-87-90185) Avail: NTIS HC A02/MF A01

The effect of transmission errors on compressed facsimile data and on uncompressed and compressed image data was evaluated. Calculated error statistics show that the burst nature of the errors is an advantage, since it reduces the number of error events. For the transmission of facsimile pages, it is shown that catastrophic errors occur only once every 44 or 65 pages for 1-D and 2-D compression, respectively, at bit error rate = 0.000001. For the transmission of image data it is shown that the number of errors in each image can be largely reduced by introducing compression; however, the effect of errors is larger in a compressed image. Certain errors lead to the loss of synchronization, which can only be recovered if the data has its own synchronization structure. ESA

N87-27881# Max-Planck-Inst. fuer Physik und Astrophysik, Munich (West Germany). Inst. fuer Physik.
CORRELATED NOISE IN SILICON STRIP DETECTOR READOUT
G. Lutz Feb. 1987 20 p
(MPE-PAE/Exp.El.173; ETN-87-90312) Avail: NTIS HC A02/MF A01

Noise correlation due to interstrip capacitances in silicon strip detector readout is discussed. For readout with directly bonded integrated electronics, due to avoidance of fanout and connected ground capacitances, interstrip capacitances dominate the capacitive load at the amplifier input. Consequences on energy and position measurement precision are calculated, and guides for an optimal choice of the readout pitch are given. ESA

N87-27882*# Ohio State Univ., Columbus. ElectroScience Lab.
OPTIMIZATION OF ORBITAL ASSIGNMENT AND SPECIFICATION OF SERVICE AREAS IN SATELLITE COMMUNICATIONS
Cou-Way Wang, Curt A. Levis, and O. Merih Buyukdura Feb. 1987 265 p
(Grant NAG3-159)
(NASA-CR-181273; NAS 1.26:181273; Rept-716548-7) Avail: NTIS HC A12/MF A01 CSCL 17B

The mathematical nature of the orbital and frequency assignment problem for communications satellites is explored, and it is shown that choosing the correct permutations of the orbit locations and frequency assignments is an important step in arriving at values which satisfy the signal-quality requirements. Two methods are proposed to achieve better spectrum/orbit utilization. The first, called the delta S concept, leads to orbital assignment solutions via either mixed-integer or restricted basis entry linear programming techniques; the method guarantees good single-entry carrier-to-interference ratio results. In the second, a basis for specifying service areas is proposed for the Fixed Satellite Service. It is suggested that service areas should be specified according to the communications-demand density in conjunction with the delta S concept in order to enable the system planner to specify more satellites and provide more communications supply. Author

N87-27883*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MONOLITHIC MICROWAVE INTEGRATED CIRCUIT (MMIC) TECHNOLOGY FOR SPACE COMMUNICATIONS APPLICATIONS
Denis J. Connolly, Kul B. Bhasin, and Robert R. Romanofsky 1987 18 p Proposed for presentation at the 38th International Astronautical Federation Congress, Brighton, England, 9-17 Oct. 1987
(NASA-TM-100187; E-3763; NAS 1.15:100187; IAF-87-491)
Avail: NTIS HC A02/MF A01 CSCL 09C

Future communications satellites are likely to use gallium arsenide (GaAs) monolithic microwave integrated-circuit (MMIC) technology in most, if not all, communications payload subsystems.

Multiple-scanning-beam antenna systems are expected to use GaAs MMICs to increase functional capability, to reduce volume, weight, and cost, and to greatly improve system reliability. RF and IF matrix switch technology based on GaAs MMICs is also being developed for these reasons. MMIC technology, including gigabit-rate GaAs digital integrated circuits, offers substantial advantages in power consumption and weight over silicon technologies for high-throughput, on-board baseband processor systems. For the more distant future pseudomorphic indium gallium arsenide (InGaAs) and other advanced III-V materials offer the possibility of MMIC subsystems well up into the millimeter wavelength region. All of these technology elements are in NASA's MMIC program. Their status is reviewed. Author

N87-27884# Naval Ocean Systems Center, San Diego, Calif.
THE SEGMENTED WAVEGUIDE PROGRAM FOR LONG WAVELENGTH PROPAGATION CALCULATIONS Technical Document Jan. - Dec. 1986
J. A. Ferguson and F. P. Snyder Apr. 1987 81 p
(AD-A181939; NOSC/TD-1071) Avail: NTIS HC A05/MF A01 CSCL 20N

A computer which obtains waveguide mode solutions for very low frequencies and low frequencies (VLF/LF) is described. The program allows for multiple homogeneous segments to be specified, allowing for consideration of variations in the Earth-ionosphere waveguide. Path geometry and geophysical parameters can be computed by the program. Ionospheric disturbances due to man-made or natural events can also be modeled using the program. GRA

N87-27885# Lee (J. S.) Associates, Inc., Arlington, Va.
PERFORMANCE ANALYSIS OF FREQUENCY HOPPING MFSK (M-ARY FREQUENCY-SHIFT-KEYING) SYSTEMS EMPLOYING FORWARD ERROR CONTROL CODING IN THE PRESENCE OF HOSTILE INTERFERENCE Final Report, May 1986 - Apr. 1987
Jhong S. Lee, Robert H. French, and Leonard E. Miller Jun. 1987 191 p
(Contract N00014-86-C-0279)
(AD-A182136; JC-2040-N) Avail: NTIS HC A09/MF A01 CSCL 09A

Error probability analyses are performed for a coded M-ary frequency-shift-keying (MFSK) system employing L hops per M-ary word frequency-hopping (FH) spread spectrum waveforms transmitted over a partial-band Gaussian noise jamming channel. The information bit error probabilities are obtained for a square-law linear combining demodulator and for a square-law adaptive gain control (AGC) demodulator, both with forward error control (FEC) coding under conditions of worst-case partial-band noise jamming, using exact analyses of the demodulator performance which include both thermal noise and jamming noise. Parametric performance curves are obtained for both block codes and convolutional codes with both binary and M-ary channel modulations. The results show that thermal noise can not be neglected in the analyses if correct determinations of the optimum order of diversity and the worst-case jamming fraction are to be obtained over the whole range of signal-to-thermal noise and signal-to-jamming ratios. It is shown that the combination of non-linear combining, M-ary modulation, and forward error control coding is an effective strategy against worst-case partial-band noise jamming. However, just as was found to be the case for uncoded systems, the linear combiner is ineffective in worst-case partial-band noise jamming.
Author (GRA)

N87-27886# Massachusetts Inst. of Tech., Lexington.
ADAPTIVE-REFERENCE NEAR- AND FAR-ECHO CANCELLATION IN THE PRESENCE OF FREQUENCY OFFSET
Thomas F. Quatieri and Gerald C. OLeary 22 May 1987 48 p
(Contract F19628-85-C-0002)
(AD-A182212; TR-771; ESD-TR-86-183) Avail: NTIS HC A03/MF A01 CSCL 20N

The results of a study of the applicability of various echo-cancelling techniques to the problem of improving the transmission of data over voiceband telephone channels are presented. The principal result of the study is a design for a novel echo-canceling configuration which permits the cancellation of a far-echo component containing a frequency offset. The modern design is based on a combined adaptive-reference echo canceller and adaptive-channel equalizer. The adaptive-reference algorithm has the advantage that interference to the echo canceller caused by the far-end signal can be eliminated by subtracting an estimate of the far-end signal based on receiver decisions. This technique is extended to provide a new approach for full-duplex far-echo cancellation in which the far echo can be cancelled in spite of carrier frequency offset. To estimate the frequency offset, the system uses a separate receiver structure for the far echo which provides equalization of the far-echo channel and tracks the frequency offset in the far echo. The feasibility of the echo-cancelling algorithms is demonstrated by computer simulation with realistic channel distortions and with 4800 b/s data transmission, at which rate frequency offset in the far echo becomes important. The design requirements for a modem implementing this algorithm are examined briefly. GRA

N87-27887# Massachusetts Inst. of Tech., Lexington.
A DUAL-FREQUENCY FEED WITH ELECTRONIC TRACKING CAPABILITY
Joseph C. Lee 22 May 1987 26 p
(Contract F19628-85-C-0002)
(AD-A182213; TR-779; ESD-TR-86-198) Avail: NTIS HC A03/MF A01 CSCL 17C

A dual-frequency Q-/K-band circularly polarized feed with electronic tracking capability was developed. Four circumferentially located, externally coupled, diode controlled, resonant cavities were used at the horn throat to produce phase-center lateral movement. When used to feed a 24-in-diam. offset paraboloidial reflector, an average beam squint from boresight of 10 percent of the 3-dB beamwidth was obtained over 5-percent bandwidth. GRA

N87-27888# Army Missile Command, Redstone Arsenal, Ala.
RESEARCH IN PRESSURE BROADENING Status Report
David W. Howgate Aug. 1986 24 p
(AD-A182251; AD-E951026; AMSMI/TR-RD-RE-86-5) Avail: NTIS HC A02/MF A01 CSCL 20E

This report presents the basic structure and workings of a rigorous and comprehensive formalism applicable to the study of gaseous mixtures interacting with an electromagnetic field. It presents new analyses and characterizations of the physical effects produced by increasing the density of pressure of the gas. A brief discussion on the overall versatility of the general approach relative to strategic areas such as Brillouin scattering and Rydberg-state interactions, the extension of its theoretical limits to include such important current thrusts as adverse-condition imaging in fog or mist, and a rigorous study of the dynamics of the free-electron laser are also presented. GRA

N87-27889# Naval Weapons Center, China Lake, Calif.
SUBARRAYING OF REACTIVELY STEERED ARRAYS FOR ADAPTIVE AND DETERMINISTIC APPLICATIONS Interim Report, Oct. 1984 - Sep. 1986
Robert J. Dinger Dec. 1986 40 p
(AD-A182344; AD-E900694; NWC-TP-6792) Avail: NTIS HC A03/MF A01 CSCL 09A

A single reactively steered adaptive array (RESAA), which contains one driven element and up to eight closely coupled parasitic elements terminated in adjustable reactive loads, does not have sufficient directive gain for many applications. Simulations have been conducted on a configuration in which the RESAA is a subarray in a much larger array. GRA

N87-27890# Army Missile Command, Redstone Arsenal, Ala. Advanced Sensors Directorate.
GROUP ORTHOGONAL ARRAYS FOR ELIMINATION OF MULTIPLE-TIME-AROUND ECHOES IN RADARS Final Technical Report, for Period Ending Jan. 1987
Edward M. Holliday and Glenn Weathers Apr. 1987 21 p
(AD-A182497; AD-E951040; AMSMI/TR-RD-AS-87-6) Avail: NTIS HC A02/MF A01 CSCL 17I

(AD-A182497; AD-E951040; AMSMI/TR-RD-AS-87-6) Avail: NTIS HC A02/MF A01 CSCL 17I

The advantage of interleaved group-orthogonal/group-complementary arrays lies in their property of sidelobe cancellation over multiple range intervals. This results in reduced clutter interference when tracking low-speed targets in clutter. With this waveform, a high PRF can be used to increase energy on target or increase Doppler coverage, and alllows detection and tracking of targets in multiple-time-around range intervals with cancellation of clutter responses from principal unambiguous range interval and from other multiple-time-around range intervals. Synthesis procedures of arrays to be interleaved to achieve zero responses in multiple-time-around range intervals are presented in this report, along with examples of the zero response features. References are also given to group-complimentary coding and other synthesis techniques of orthogonal binary arrays. Author (GRA)

N87-27891# Rome Air Development Center, Griffiss AFB, N.Y.
NARROWBAND 10 GHz AND 20 GHz GaAs FET AMPLIFIERS IN COPLANAR WAVEGUIDE M.S. Thesis
Peter J. Rainville Oct. 1986 127 p
(AD-A182751; RADC-TR-86-169) Avail: NTIS HC A07/MF A01 CSCL 09A

Single-stage, narrowband 10 GHz and 20 GHz GaAs field effect transistor (FET) amplifiers using coplanar waveguide (CPW) distributed matching elements were built and tested. The amplifiers were constructed to closely model monolithic amplifiers on GaAs by mounting GaAs FET chips into an epsilon (r) = 13 substrate material, onto which the CPW matching elements were placed. A CPW test fixture was designed and a routine for de-embedding the s-parameters of FET chips mounted in CPW was developed and successfully used. The 10-GHz amplifiers had an average of 9 dB gain. Due to a de-embedding error none of the 20-GHz amplifiers provided positive gain at 20 GHz. A second de-embedding effort yielded s-parameters that were used to accurately predict the actual performance of the 20-GHz amplifier designs. GRA

N87-27892# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
URSI, COMMISSION C, SIGNALS AND SYSTEMS REPORT ON CONTRIBUTIOS IN BRAZIL (1984-1986)
Max Henrique MachadoCosta Feb. 1987 16 p
(INPE-4129-RPE/538) Avail: NTIS HC A02/MF A01

This review is a compilation of Brazilian contributions to the URSI Commission C publication, Signals and Systems, published in English and French in the period from October l983 to September 1986. It focusses on academic contributions in the field of telecommunications. Author

N87-27893# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
RESULTS ON VLF LONG-DISTANCE PROPAGATION RECEIVED AT BRAZIL AND AT ANTARCTIC PENINSULA
L. R. Piazza, A. MendesdaCosta, P. Kaufmann, V. L. R. Kuntz, N. M. PaesLeme, and M. S. S. MacedoMoura Mar. 1987 18 p Presented at the Biregional Latin-America-African Workshop on Radiopropagation Research and Applications, Buenos Aires, Argentina, 1-4 Apr. 1987
(INPE-4134-PRE/1045) Avail: NTIS HC A02/MF A01

Recent results are presented of VLF long-distance propagation obtained at Itapetinga Radio Observatory, Atibaia, Brazil, and at Antarctic Station Commandante Ferraz, King George Island, Antarctic Peninsula. The signals originated in North West Cape, Australia. Author

N87-27894# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A COMMUNICATION SYSTEM FOR A MULTIPROCESSING ENVIRONMENT [UM SISTEMA DE COMUNICACAO PARA AMBIENTE DE MULTIPROCESSAMENTO]
Eliane Martins Jun. 1987 15 p In PORTUGUESE; ENGLISH summary Presented at the First Brazilian Symposium of Computer Architecture, Gramado, RS, 13-15 Apr. 1987 Submitted for publication
(INPE-4155-PRE/1059) Avail: NTIS HC A02/MF A01

The communication system presented is part of a distributed system designed for the Multiprocessor for Network Communication (MCR) developed at INPE/MCY. This system provides the means for interprocess communication through channels. A channel permits the transfer of data between cooperating processes, indpendently of where these processes are being executed. The MCR, which purpose is the control of interfaces from serial communication, was designed to support the implementation of the lower levels of a communication protocol and auxiliary routing routines. Author

N87-27895# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
HIGH PERFORMANCE DISK MONITOR APPLICATIONS IN REAL TIME M.S. Thesis [MONITOR DE DISCO DE ALTO DESEMPENHO PARA APLICACOES EM TEMPO REAL]
Mauricio MacedodeFaria Apr. 1987 199 p In PORTUGUESE; ENGLISH summary
(INPE-4149-TDL/267) Avail: NTIS HC A09/MF A01

The theoretical concepts involved in the design and implementation of a High Performance Disk Monitor Program are presented. An implementation proposal detailing the relevant aspects required to obtain high performance, simplicity, and portability is also presented. Author

N87-27601*# Ohio Univ., Athens.
DIGITAL AUTONOMOUS TERMINAL ACCESS COMMUNICATIONS
S. Novacki *In* NASA, Langley Research Center, Joint University Program for Air Transportation Research, 1985 Jul. 1987 p 43-46 (For primary document see N87-27596 22-01)
Avail: NTIS HC A05/MF A01 CSCL 17B

N87-27822# Joint Publications Research Service, Arlington, Va.
BISTATIC RADAR USING COSMIC RADIO EMISSIONS Abstract Only
A. G. Pavelyev and A. I. Kucheryavenkov *In its* USSR Report: Electronics and Electrical Engineering 6 Aug. 1987 p 7 Transl. into ENGLISH from Izvestiya Vysshikh Uchebnykh Zavedeniy: Radiofizika (Gorkiy, USSR), v. 29, no. 8, Aug. 1986 p 871-877 (For primary document see N87-27821 22-31)
Avail: NTIS HC A05/MF A01

N87-27823# Joint Publications Research Service, Arlington, Va.
POSSIBILITIES OF USING COSMIC RADIATION SOURCES FOR LUNAR AND PLANETARY RESEARCH Abstract Only
N. A. Armand, A. G. Pavelyev, A. I. Kucheryavenkov, and D. Ya. Shtern *In its* USSR Report: Electronics and Electrical Engineering 6 Aug. 1987 p 8 Transl. into ENGLISH from Radiotekhnika i Elektronika (Moscow, USSR), v. 31, no. 8, Aug. 1986 p 1620-1626 Original language document was announced in IAA as A87-17514 (For primary document see N87-27821 22-31)
Avail: NTIS HC A05/MF A01

N87-27825# Joint Publications Research Service, Arlington, Va.
QUASI-OPTIMUM ALGORITHM OF SPACE-TIME SIGNAL PROCESSING BY LARGE ADAPTIVE ANTENNA ARRAY Abstract Only
V. N. Manzhos, V. N. Kokin, and N. I. Kamchatnyy *In its* USSR Report: Electronics and Electrical Engineering 6 Aug. 1987 p 15 Transl. into ENGLISH from Radiotekhnika (Moscow, USSR), no. 9, Sep. 1986 p 7-12 Original language document was announced in IAA as A87-21713 (For primary document see N87-27821 22-31)
Avail: NTIS HC A05/MF A01

N87-27826# Joint Publications Research Service, Arlington, Va.
ACCURACY OF AZIMUTH OF MOVING TARGET MEASUREMENT BY RADAR WITH SYNTHESIZED APERTURE Abstract Only

A. T. Abrarov, V. N. Antipov, and G. S. Kondratenkov *In its* USSR Report: Electronics and Electrical Engineering 6 Aug. 1987 p 15-16 Transl. into ENGLISH from Radiotekhnika (Moscow, USSR), no. 9, Sep. 1986 p 18-21 (For primary document see N87-27821 22-31)
Avail: NTIS HC A05/MF A01

N87-27827# Joint Publications Research Service, Arlington, Va.
QUASI-OPTIMUM ALGORITHMS OF RADIO SIGNAL RECEPTION AND PROCESSING WITH INCLUSION OF ANOMALOUS TRACKING MODES Abstract Only
M. A. Mironov and M. S. Yalykov *In its* USSR Report: Electronics and Electrical Engineering 6 Aug. 1987 p 31 Transl. into ENGLISH from Radiotekhnika i Elektronika (Moscow, USSR), v. 31, no. 8, Aug. 1986 p 1520-1533 Original language document was announced in IAA as A87-17505 (For primary document see N87-27821 22-31)
Avail: NTIS HC A05/MF A01

N87-28158# Marconi Co. Ltd., Chelmsford (England).
TEXTURE ANALYSIS IN SYNTHETIC APERTURE RADAR IMAGERY
J. Lamont and P. Klein *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 295-300 (For primary document see N87-28115 22-43)
Copyright Avail: NTIS HC A14/MF A01

N87-28392# Joint Publications Research Service, Arlington, Va.
COMPOUND OPTOACOUSTIC GRAVITATIONAL ANTENNA Abstract Only
V. V. Kulagin, A. G. Polnarev, and V. N. Rudenko *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 52 Transl. into ENGLISH from Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 91, no. 5(11), Nov. 1986 p 1553-1564 Original language document was announced in IAA as A87-27576 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

N87-27896# Duracell, Inc., Needham, Mass. Research Center.
ALL INORGANIC AMBIENT TEMPERATURE RECHARGEABLE LITHIUM BATTERY Final Report, Nov. 1980 - Jun. 30, 1985
H. C. Kuo, A. N. Dey, C. Schlaikjer, D. Foster, and M. Kallianidis 1987 220 p
(Contract DE-AC01-80ER-10191)
(DE87-005020; DOE/ER-10191/T1) Avail: NTIS HC A10/MF A01

Research and development was carried out on ambient-temperature rechargeable lithium batteries with inorganic SO2 electrolytes. The following solutes in SO2 were studied: tetrachloroaluminates, LiAlCl4, Li2B10Cl10, and LiGaCl4. Copper chloride (CuCl2) was used as one of the electrode materials. DOE

N87-27897# Sandia National Labs., Albuquerque, N. Mex.
PHOTOCURRENT MODELING
E. W. Enlow, O. Stuetzer, D. R. Alexander, and J. R. Barnum 1987 6 p Presented at the 24th Annual Conference on Nuclear and Space Radiation in Electronics, Snowmass, Colo., 28 Jul. 1987 Prepared in cooperation with Mission Research Corp., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(DE87-005065; SAND-87-7030C; CONF-870724-2) Avail: NTIS HC A02/MF A01

Mathematical models are described for time dependent photocurrent in a PN junction. The models incorporate high injection effects on lifetime, electric fields in the bulk quasi-neutral region, and diode length effects. A subroutine suitable for use in SPICE 2 implements the models. DOE

N87-27898# Oak Ridge National Lab., Tenn.
ELECTRON TRANSPORT STUDIES OF GASEOUS MEDIA FOR DIFFUSE DISCHARGE CLOSING SWITCHES
S. R. Hunter, J. G. Carter, and L. G. Christophorou 1987 3 p Presented at the 18th International Conference on Phenomena in Ionized Gases, Swansea, England, 13 Jul. 1987
(Contract DE-AC05-84OR-21400)
(DE87-005327; CONF-870723-3) Avail: NTIS HC A02

High current, self-sustained diffuse discharges may be used as alternatives to spark gaps in fast closing, high repetition rate switching applications. The primary motivation for using diffuse discharges in comparison with arc discharges is that a diffuse discharge has a much faster recovery time (less than 10 to the -4s) in comparison with an arc discharge (greater than 10 to the -3s). The major disadvantages with self-sustained diffuse discharges are the high impedance (i.e., low switch efficiency; presently 50 to 80% at best) and the inherent instability of the discharge. This paper describes measurements of the electron drift velocity, w, electron attachment coefficient, eta/N sub T , and ionization coefficient, alpha/N sub T, in a new type of gas mixture which can be used in these switches to considerably lower the operating voltage of the diffuse discharge (i.e., increase the switch efficiency), while at the same time improving the discharge stability. DOE

N87-27899# Sandia National Labs., Albuquerque, N. Mex.
MECHANISMS FOR INTERFACE-TRAP GENERATION IN POLYSILICON GATE DEVICES
J. R. Schwank, P. S. Winokur, P. V. Dressendorfer, D. C. Turpin, and D. T. Sanders 1987 5 p Presented at the 24th Annual Conference on Nuclear and Space Radiation in Electronics, Snowmass, Colo., 28 Jul. 1987
(Contract DE-AC04-76DP-00789)
(DE87-005842; SAND-87-0285C; CONF-870724-7) Avail: NTIS HC A02/MF A01

Interface-traps have been measured on transistors immediately after a pulse of ionizing radiation using a fast subthreshold I-V technique. Results are presented for interface-trap generation as a function of temperature and for different process conditions. These studies more clearly identify the physical mechanisms of interface-trap generation for polysilicon gate CMOS devices. DOE

N87-27900# Sandia National Labs., Albuquerque, N. Mex.
FAILURE MECHANISMS OF INTEGRATED CIRCUITS IN SPACE
P. S. Winokur, F. W. Sexton, and G. L. Hash 1987 8 p Presented at the 24th Annual Conference on Nuclear and Space Radiation in Electronics, Snowmass, Colo., 28 Jul. 1987
(Contract DE-AC04-76DP-00789)
(DE87-005848; SAND-87-0286C; CONF-870724-6) Avail: NTIS HC A02/MF A01

Failure mechanisms in low-dose-rate space environments are identified for ICs from hardened and commercial CMOS technologies and from advanced bipolar technologies. These failure mechanisms are often quite different than those observed at higher dose rates specified in total-dose test guidelines. DOE

N87-27901# Army Armament Research, Development and Engineering Center, Picatinny Arsenal, N.J. Information Management Directorate.
AUTOMATED SEMICONDUCTOR MODELING
John P. Tobak May 1987 43 p
(AD-A181133; ARIMD-TR-87001) Avail: NTIS HC A03/MF A01 CSCL 20L

A procedure is presented for the automatic creation of diode and transistor models used by the circuit and systems analysis

computer program SUPER*SCEPTRE. A Hewlett Packard 9816s microcomputer and 4145B semiconductor parameter analyzer are used to control the process. GRA

N87-27902# Societe des Accumulateurs Fixes et de Traction, Romainville (France). Dept. Generateurs Speciaux.
POTENTIAL NON-CORRODABLE TERMINAL SEALS FOR NICKEL-CADMIUM CELLS Final Report
D. Paugam Paris, France ESA 25 Jun. 1986 129 p Prepared for the UKAEA, Harwell, England
(Contract ESTEC-5549/83-NL-BI(CS))
(UAS/PS-080/86; ESA-CR(P)-2350; ETN-87-99997) Avail: NTIS HC A07/MF A01

Corrosion resistant brazes to seal electrodes into casings of batteries required for satellites were identified. Fabrication of alumina-Dilver PI seals by noncorrodable brazes may be achieved by activating the ceramic with TiH2 and using gold or nickel alloy brazes, or by using such alloys modified by reactive metal additions without the need for activation. Alternatively, the seals might be made by using reactive metal inserts that form eutectic reactive brazes by alloying with Dilver PI, or by diffusion bonding. It is recommended that the proposal to replace Dilver PI components with stainless steel should not be executed. Based on brazing trials, gold 17% nickel alloy with TiH2 activated alumina and the use of titanium foil are recommended for more detailed optimization. Diffusion bonding using corrosion resistant interlayers should also be considered as an alternative fabrication route. ESA

N87-27903# Direction des Recherches Etudes et Techniques, Paris (France). Direction Scientifique Veille Scientifique et Technique.
INTRODUCTION TO THE EFFECT OF SPACE RADIATION ON SEMICONDUCTORS [INTRODUCTION A L'EFFET DES RADIATIONS SPATIALES SUR LES SEMICONDUCTEURS]
Maurice Labedan Jun. 1986 40 p In FRENCH
(ETN-87-90132) Avail: NTIS HC A03/MF A01

The characterization of radiation sources near Earth, influence on satellite semiconductors, the computation of radiation flux through the protecting devices, and a comparison of the inherent resistance of several technologies because of circuit design or due to manufacturing procedure are discussed. The interactions of research and defense requirements are considered. The additional problems appearing with submicronic circuits are commented. ESA

N87-27904# Plessey Research (Caswell) Ltd., Towcester (England).
A 12 GHz SOLID STATE POWER AMPLIFIER, PHASE 1B Final Report
P. R. Bestwick Paris, France ESA May 1986 98 p
(Contract ESA-5483/83-NL-PP(SC))
(CD.6501736; ESA-CR(P)-2376; ETN-87-90162) Copyright
Avail: NTIS HC A05/MF A01

Attempts to develop a balanced amplifier developing 4 W power output at 12.6 GHz, with a gain of 3.5 dB are summarized. Calculation of the device large-signal conjugate match points, measurement of the points, design and tuning of single-ended amplifier, modules, and a bias insertion network are described. A Lange coupler and a termination for it are presented. The performance of the balanced amplifier, and that of a competing Fujitsu amplifier, are analyzed. The differences in device structure between the PRCL 4820 device and the Fujitsu device are assessed. The amplifier developed gives (at 1 dB gain compression) a gain of 2.4 dB and a power output of 3.2 dB. Difficulties stem from the use of the double-cell 4820 device, and of the Lange type quadrature couplers. ESA

N87-27905*# Texas Univ. at Dallas, Richardson.
NONLINEAR FILTER DESIGN
L. R. Hunt and Paul Whitney [1987] 15 p
(Grant NAG2-366)
(NASA-CR-181239; NAS 1.26:181239) Avail: NTIS HC A02/MF A01 CSCL 09C

A technique for identifying nonlinear systems was introduced, beginning with a single input-single output system. Assuming the system is initially at rest, the first kernel (first convolution integral in the continuous case or first convolution sum in the discrete case) was calculated. A controllable and observable linear realization was then obtained in a particular canonical form. The actual nonlinear system was probed with an appropriate input (or inputs) and the output (or outputs) determined. For the linear system, the input was computed that produces the same output. In the difference between the inputs to the nonlinear and linear systems, basic information was found about the nonlinear system. There is an interesting class of nonlinear systems for which this type of identification scheme should prove to be accurate. B.G.

N87-27906*# Texas A&M Univ., College Station. Dept. of Chemistry.
NEW SECONDARY BATTERIES UTILIZING ELECTRONICALLY CONDUCTIVE POLYMER CATHODES Final Report, 1 Sep. 1986 - 31 Aug. 1987
Charles R. Martin and Ralph E. White Aug. 1987 164 p
(Grant NAG9-173)
(NASA-CR-181216; NAS 1.26:181216) Avail: NTIS HC A08/MF A01 CSCL 09C

The objectives are to optimize the transport rates in electronically conductive polypyrrole films by controlling the morphology of the film and to assess the utility of these films as cathodes in a lithium/polypyrrole secondary battery. During this research period, a better understanding was gained of the fundamental electrochemical switching processes within the polypyrrole film. Three publications were submitted based on the work completed. For individual titles, see N87-27907 through N87-27909.

N87-27907*# Texas A&M Univ., College Station. Dept. of Chemistry.
AC IMPEDANCE ANALYSIS OF POLYPYRROLE THIN FILMS
Reginald M. Penner (Stanford Univ., Calif.) and Charles R. Martin *In its* New Secondary Batteries Utilizing Electronically Conductive Polymer Cathodes Aug. 1987 54 p (For primary document see N87-27906 22-33)
Avail: NTIS HC A08/MF A01 CSCL 09C

The AC impedance spectra of thin polypyrrole films were obtained at open circuit potentials from -0.4 to 0.4 V vs SCE. Two limiting cases are discussed for which simplified equivalent circuits are applicable. At very positive potentials, the predominantly nonfaradaic AC impedance of polypyrrole is very similar to that observed previously for finite porous metallic films. Modeling of the data with the appropriate equivalent circuit permits effective pore diameter and pore number densities of the oxidized film to be estimated. At potentials from -0.4 to -0.3 V, the polypyrrole film is essentially nonelectronically conductive and diffusion of polymer oxidized sites with their associated counterions can be assumed to be linear from the film/substrate electrode interface. The equivalent circuit for the polypyrrole film at these potentials is that previously described for metal oxide, lithium intercalation thin films. Using this model, counterion diffusion coefficients are determined for both semi-infinite and finite diffusion domains. In addition, the limiting low frequency resistance and capacitance of the polypyrrole thin fims was determined and compared to that obtained previously for thicker films of the polymer. The origin of the observed potential dependence of these low frequency circuit components is discussed. Author

N87-27908*# Texas A&M Univ., College Station. Dept. of Chemistry.
DETERMINATION OF DIFFUSION COEFFICIENTS IN POLYPYRROLE THIN FILMS USING A CURRENT PULSE RELAXATION METHOD
Reginald M. Penner (Stanford Univ., Calif.), Leon S. VanDyke, and Charles R. Martin *In its* New Secondary Batteries Utilizing Electronically Conductive Polymer Cathodes Aug. 1987 50 p (For primary document see N87-27906 22-33)
Avail: NTIS HC A08/MF A01 CSCL 09C

The current pulse E sub oc relaxation method and its application to the determination of diffusion coefficients in electrochemically synthesized polypyrrole thin films is described. Diffusion coefficients for such films in Et4NBF4 and MeCN are determined for a series of submicron film thicknesses. Measurement of the double-layer capacitance, C sub dl, and the resistance, R sub u, of polypyrrole thin films as a function of potential obtained with the galvanostatic pulse method is reported. Measurements of the electrolyte concentration in reduced polypyrrole films are also presented to aid in the interpretation of the data. B.G.

N87-27909*# Texas A&M Univ., College Station. Dept. of Chemistry.

A MATHEMATICAL MODEL FOR PREDICTING CYCLIC VOLTAMMOGRAMS OF ELECTRONICALLY CONDUCTIVE POLYPYRROLE

Taewhan Yeu, Trung V. Nguyen, and Ralph E. White *In its* New Secondary Batteries Utilizing Electronically Conductive Polymer Cathodes Aug. 1987 28 p (For primary document see N87-27906 22-33)

Avail: NTIS HC A08/MF A01 CSCL 09C

Polypyrrole is an attractive polymer for use as a high-energy-density secondary battery because of its potential as an inexpensive, lightweight, and noncorrosive electrode material. A mathematical model to simulate cyclic voltammograms for polypyrrole is presented. The model is for a conductive porous electrode film on a rotating disk electrode (RDE) and is used to predict the spatial and time dependence of concentration, overpotential, and stored charge profiles within a polypyrrole film. The model includes both faradic and capacitance charge components in the total current density expression. Author

N87-27910*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

IN-CIRCUIT FAULT INJECTOR USER'S GUIDE

Peter A. Padilla Jun. 1987 24 p

(NASA-TM-100478; NAS 1.15:100478) Avail: NTIS HC A02/MF A01 CSCL 09C

A fault injector system, called an in-circuit injector, was designed and developed to facilitate fault injection experiments performed at NASA-Langley's Avionics Integration Research Lab (AIRLAB). The in-circuit fault injector (ICFI) allows fault injections to be performed on electronic systems without special test features, e.g., sockets. The system supports stuck-at-zero, stuck-at-one, and transient fault models. The ICFI system is interfaced to a VAX-11/750 minicomputer. An interface program has been developed in the VAX. The computer code required to access the interface program is presented. Also presented is the connection procedure to be followed to connect the ICFI system to a circuit under test and the ICFI front panel controls which allow manual control of fault injections. Author

N87-27911# Argonne National Lab., Ill.

MOLTEN SALT BATTERY ADVANCES

T. D. Kaun, L. Redey, and P. A. Nelson 1987 7 p Presented at the 22nd Intersociety Energy Conversion Engineering Conference, Philadelphia, Pa., 10 Aug. 1987

(Contract W-31-109-eng-38)

(DE87-011402; CONF-870804-13) Avail: NTIS HC A02

Recently, development of Li-alloy/metal sulfide cells with molten-salt electrolyte for high performance applications has concentrated on improvement of the electrode performance and cell capacity stability. New electrochemistries and porous electrode compositions have provided a strong foundation for further development of Li-alloy/dense upper-plateau (U.P.) FeS2 (1.75 V) cells, as well as Li-alloy/FeS (1.32V) cells. (U.P. FeS2 refers to the discharge reaction of FeS2 to Li2FeS2.) A lithium-limited FeS cell has demonstrated 100 Wh/kg at a 3-h rate and 100 W/kg at 80% depth of discharge (DOD), while a dense U.P. FeS2 cell is now capable of 175 Wh/kg at a 4-h rate and 200 W/kg at 80% DOD. Both types have demonstrated stable cycle life of greater than 400 cycles, with 1000 cycle-life expectancy. Earlier FeS2 cells suffered from an appreciable (0.1 to 0.25%/cycle) cell capacity decline rate, which has been eliminated by recent innovations. A new molten-salt electrolyte, LiCl-LiBr-KBr (m.p. 310 C), improved performance and allowed a lower cell operating temperature of 400 C, from 425 to 450 C for earlier cells. Cell design flexibility, along with the high conductivity electrolyte and high energy density electrodes, offers a broad range of capability. A bipolar design with U.P. FeS2 electrodes is projected to provide specific energy of 200 Wh/kg and specific power up to 5 kW/kg. Preliminary tests with a new cell design for reduced materials costs showed that the Li-Al/U.P. FeS2 couple was capable of high specific energy in a rod-electrode configuration. DOE

N87-27912# Technische Hogeschool, Eindhoven (Netherlands).

NEGATIVE CORONA DISCHARGES: A FUNDAMENTAL STUDY Ph.D. Thesis

Bastiaan Gravendeel 1987 156 p Sponsored by the Netherlands Foundation for Technical Research

(ETN-87-90246) Avail: NTIS HC A08/MF A01

Negative corona discharge in air in the Trichel regime was studied using fast current measurements (resolution 0.7 ns), mass spectrometry, and fast light intensity measurements resolved with time resolution 0.7 ns, in space resolution 0.05 mm, and wavelength resolution 0.16 nm. A theoretical expression which relates the externally measured current with the movement of charges inside an inhomogeneous field gap in the vicinity of space charge is derived. The rise time of Trichel pulses in atmospheric air is measured to be 1.15 ns. The cut-off of a Trichel pulse is due to the decrease of the local electric field in which the electron avalanche moves. A new Trichel pulse can occur only if the positive and negative ion clouds formed during the previous Trichel pulse disappear and the original field configuration is sufficiently restored. ESA

N87-27913 Technische Hogeschool Twente, Enschede (Netherlands).

ON THE APPLICATION OF SUPERCONDUCTORS IN POWER TRANSFORMERS Ph.D. Thesis

Frank vanOverbeeke 1986 231 p Sponsored by the Stichting voor Fundamenteel Onderzoek der Materie

(ISBN-90-9001430-6; B8682221; ETN-87-90248) Copyright Avail: Issuing Activity

Operational properties of superconducting wires suitable for application in the windings of a high-power transformer are discussed. It is shown that superconductors can be produced having ac losses lower than those of a copper coil in the same configuration, including the coefficient of performance of the refrigeration system. Low ac losses in a multifilamentary wire can be realized by providing it with a high-resistivity matrix or a mixed matrix that has a sufficiently high transverse resistivity, by giving the wire a tight twist and by realizing small filament diameters. The wire should be designed for a relatively small critical current. The desired current-carrying capacity of a conductor is obtained by twisting or braiding a number of wires into a cable, making them electromagnetically equivalent by fully transposing all strands. ESA

N87-27914# Johnson Controls, Inc., Milwaukee, Wis.

ZINC-BROMINE BATTERY DEVELOPMENT

J. P. Zagrodnik and M. D. Eskra 10 Aug. 1987 6 p Presented at the 22nd Intersociety Energy Conversion Engineering Conference, Philadelphia, Pa., 10 Aug. 1987 Prepared in cooperation with Sandia National Labs., Albuquerque, N. Mex.

(Contract DE-AC04-76DP-00789)

(DE87-009503; SAND-87-7115C; CONF-870804-2) Avail: NTIS HC A02/MF A01

A 20 kWh electric vehicle battery, Z20-low profile, was assembled and tested as part of a contract sponsored by Sandia National Laboratories (SNL). Cycling included capacity tests, power tests, and standing self-discharge tests. A 20 kWh load-leveling module was also designed, assembled, and tested at the recently completed load management test facility at JCI. Two 21 kWh battery systems were constructed and tested in a modified full size Dodge van. This was the first integrated demonstration of a

zinc-bromine battery in a road worthy vehicle. The vehicle was equipped with full instrumentation to study the battery's characteristics under actual driving conditions. DOE

N87-27915# Sandia National Labs., Albuquerque, N. Mex.
GaAs/Al/SUB 0.3/Ga/SUB 0.7/As, HETEROJUNCTION BIPOLAR TRANSISTORS FOR HIGH-TEMPERATURE (T GREATER THAN 300 C), POWER ELECTRONIC APPLICATIONS
T. E. Zipperian, T. M. Brennan, and B. E. Hammons 1987 18 p Presented at the 5th Symposium on Energy Engineering Sciences, Argonne, Ill., 17 Jun. 1987
(Contract DE-AC04-76DP-00789)
(DE87-011320; SAND-87-1632C; CONF-870679-1) Avail: NTIS HC A02/MF A01

Solid-state devices formed from compound semiconductor materials like GaAs, GaP, SiC, and (Al,Ga)As have long been viewed as candidates for use in electronic circuits functioning at temperatures greater than 300°C. To address the specific needs of power semiconductor devices operating simultaneously at high currents, voltages, and high temperatures, heterojunction devices formed from combinations of GaAs and (Al,Ga)As have recently been proposed. These novel heterojunction structures display reduced resistive and voltage parasitics when compared to wide-bandgap GaP or SiC, homojunction diodes without seriously compromising control of thermally generated leakage currents. In this study, a prototype, low-power, (Al,Ga)As/GaAs, heterojunction bipolar transistor (HBT) is described which has demonstrated excellent electrical characteristics in the 300 to 400°C temperature range. At 350°C, the HBT has a common-emitter current gain of 14 (V sub CE = 5V, I sub C = 10 mA) and collector-base leakage of 6.4 x 10 to the -2 power A/cm² (V sub CB 5 V). DOE

N87-27916# Argonne National Lab., Ill.
POWER PERFORMANCE OF HIGH-TEMPERATURE Li-ALLOY/FeS2 BIPOLAR CELLS IN SHORT PULSES
Laszlo Redey 1987 7 p Presented at the 22nd Intersociety Energy Conversion Engineering Conference, Philadelphia, Pa., 10 Aug. 1987
(Contract W-31-109-eng-38)
(DE87-011388; CONF-870804-14) Avail: NTIS HC A02

A new class of the lithium-alloy/metal-disulfide secondary cells, characterized by a thin, bipolar cell construction, and very high specific power and power-to-energy ratio (galvanic capacitors) has been developed and studied. Several versions of these cells (varied in their chemistry and geometry) were investigated in 0.1- to 1000-ms high-intensity (3 to 50 A/sq cm) current pulses. A 25-W/sq cm peak power, 200-kW/cu dm power density, and 350-Wh/cu dm energy density have been achieved in repetitive 1- to 10-ms pulses and in several cycles for Li-Al/FeS2 galvanic-capacitor cells. In investigating the operational principles of this system, it was found that (1) the power of well-designed battery cells is controlled by the ohmic resistances of the cell components when the current pulses are shortened to less than 10 ms, and (2) the voltage loss vs current density relationship at any specified state of discharge is nearly linear if the voltage-loss values are compared at identical times to the pulses of the different current densities. On the basis of the latter finding, a precise and simple way is proposed to measure, characterize, and compare various power-performance indicators of bipolar battery cells. DOE

N87-27917# Sandia National Labs., Albuquerque, N. Mex. Inorganic Processes Div.
DEVELOPMENT OF CABAL GLASSES FOR USE IN LITHIUM AMBIENT-TEMPERATURE BATTERIES
Randall D. Watkins Jun. 1987 21 p
(Contract DE-AC04-76DP-00789)
(DE87-011582; SAND-87-0393) Avail: NTIS HC A02/MF A01

Calcium-boro-aluminate (CABAL) glasses have been developed for use as electrically insulating sealing glasses in lithium ambient-temperature batteries. CABAL glasses have superior corrosion resistance in lithium/electrolyte environments relative to TA-23, and battery lifetimes are now being projected beyond 25 y. In addition, these glasses require much lower melting and sealing temperatures than TA-23. This report outlines the evolution of the CABAL glass technology at Sandia, from original composition selection to identification of the optimum CABAL-12 composition. Seal processing including commercial glass fabrication, mechanical testing, and microstructural evaluation are discussed, and the results of our initial technology transfer efforts are summarized. DOE

N87-27918# Stanford Univ., Calif. Center for Integrated Systems.
A STATIC RAM AS A FAULT MODEL EVALUATOR
John M. Acken and Mark Horowitz 1987 6 p
(Contract MDA903-83-C-0335)
(AD-A182300) Avail: NTIS HC A02/MF A01 CSCL 09A

This investigation considers the relationship between the physical failures that occur during fabrication and the resulting faulty behavior of the circuit. Fault models are used to describe the operation of integrated circuits containing physical failures introduced during fabrication. The effectiveness of fault models is dependent upon both the accuracy of the model and the occurrence of the underlying failure mechanism. A specially designed static RAM provides the size, design style, and testability required of a fault model test bed. An actual RAM implementation is described which was used for evaluation of fault models. GRA

N87-27919# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
MASK EXTRACTION FROM OPTICAL IMAGES OF VLSI CIRCUITS
Hong Jeong and Bruce R. Musicus 1987 6 p Sponsored in part by OKI-Semiconductor, Inc.
(Contract N00014-81-K-0742; Grant NSF ECS-84-07285)
(AD-A182301) Avail: NTIS HC A02/MF A01 CSCL 09A

This paper explores line labeling algorithms for extracting the mask layers from an optical image of a VLSI chip. Next, representation schemes for object features are introduced, together with the natural constraints these features satisfy. This label set is an extension of Huffman, Clowes, and Kanade's label sets. Finally, it is shown how to interpret VLSI scenes by using a constrained labeling strategy. Performance of the labeling algorithms is demonstrated on some simple but representative simulated images of CMOS logic gates. GRA

N87-27920# IBM Federal Systems Div., Manassas, Va.
ELECTRICAL CHARACTERIZATION OF VLSI RAMS AND PROMS Final Report, May 1984 - May 1986
T. Barr, T. Hoang, R. Moyers, P. Pfeiffer, and T. Scott Feb. 1987 245 p
(Contract F30602-84-C-0079)
(AD-A182334; RADC-TR-86-146) Avail: NTIS HC A11/MF A01 CSCL 09A

Electrical characterizations were performed on 256K and 1M dynamic RAMS, 64K static RAMs, 64K PROMs, and 64KEE PROMs available from the merchant semiconductor industry. Based on the data obtained on the DRAMs, SRAMs and PROMs, parameter limits were established and proposed for the draft MIL-M-38510/XXX specifications. Also, based on the data obtained on the EEPROMs, parameter limits were established and a recommended test methodology was proposed. Gate array status and recommendations were also made. The data, proposed limits and test methodologies and the related discussions, are presented. GRA

N87-27921# Electrochemical Society, Inc., Pennington, N.J.
SHIPS: HIGH-LEVEL PROCESS SIMULATION FOR VLSI (VERY LARGE SCALE INTEGRATED) MANUFACTURING
Steven D. Leeke and Krishna Saraswat 28 Feb. 1987 3 p
(Contract MDA903-80-C-0432)
(AD-A182356) Avail: NTIS HC A02/MF A01 CSCL 09A

Very large scale integration fabrication is a complex set of operations set within a rapidly changing technology environment.

It is subject to chance variations in process parameters, poor understanding and control of many parameters, and subtle interactions between them. At the same time, processing times and costs are increasing. The natural side-effect of these is that IC manufactures must require more evidence that the predicted and actual process characteristics will be within a tight tolerance. The prevailing means to verify process performance is through simulation. Unfortunately, while traditional process simulation tools such as SUPREM III have become pervasive in the IC industry as design aides for process development, they are not suited to the problems of manufacturing-level process simulation. What is required is a high-level process simulation tool that can introduce abstractions that reduce complexity and algorithms that reduce simulation costs. We have built such a tool called SHIPS, which stands for Stanford High-Level Incremental Process Simulator. The SHIPS tool provides a high-level process description language, a structured user-interface, and a new simulation algorithm for reducing the number of modules that must be simulated in analyzing the manufacturability of a process. GRA

N87-27922# Raytheon Co., Bedford, Mass. Missile Systems Div.

VLSI/VHSIC (VERY LARGE SCALE INTEGRATED/VERY HIGH SPEED INTEGRATED CIRCUITS) PACKAGE TEST DEVELOPMENT Final Report, Dec. 1983 - Dec. 1985

Kay E. Clark Dec. 1986 248 p Original contains color illustrations

(Contract F30602-84-C-0015)

(AD-A182360; RADC-TR-86-94) Avail: NTIS HC A11/MF A01 CSCL 09A

The test methods of MIL-STD-883 were reviewed to assess their appropriateness in view of the new package styles and materials being used for VLSI/VHSIC devices. Experiments were performed to judge the effectiveness of existing tests. Changes to existing tests are proposed where deemed necessary and new tests are developed where no existing method adequately assesses new technology devices. Proposed changes and/or new package tests evaluate: solderability of leads; pin grid lead pull strength; leadless chip carrier bond strength; die attach bond analysis; characteristic impedance, capacitance, and delay time of high speed signals; crosstalk; and flip-chip pull strength. GRA

N87-27923# Massachusetts Univ., Amherst. Dept. of Electrical and Computer Engineering.

TECHNOLOGY DEVELOPMENT FOR MILLIMETER WAVE PHASED ARRAYS Final Report, Jan. 1984 - Oct. 1986

Daniel H. Schaubert, K. S. Yngvesson, David M. Pozar, and Robert W. Jackson May 1987 140 p

(Contract F19628-84-K-0022)

(AD-A182608; RADC-TR-87-42) Avail: NTIS HC A07/MF A01 CSCL 09A

This project investigated architectures, radiators, FET amplifiers and oscillators that could be used in monolithic millimeter wave phased arrays. These investigations contribute to an understanding of the performance of integrated phased arrays. For example, scan blindness associated with surface waves and competition with active components for limited substrate surface area lead to designs with more than one substrate. It has been shown that feed lines can couple electromagnetically to microstrip paths through apertures in an intervening ground plane, and this allows using the beat substrate for each function. Injection locked oscillators using FETs in microstrip and coplanar waveguide circuits were developed as phase controlled sources for transmitter or local oscillators. GRA

N87-27924# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

SWITCHING POWER SUPPLIES 10V/25A [FONTE CHAVEADA 10V/25A]

Antonio Claret PereiraFernandes Jun. 1987 95 p In PORTUGUESE; ENGLISH summary

(INPE-4191-NTE/270) Avail: NTIS HC A05/MF A01

The design and assembling procedure of a 250 W switching power supply for filament heating in ion microthrusters are described. The relevant circuits are described in detail to encourage their application to other projects. Author

N87-27925# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

A 4-CHANNEL TIME DELAYED PULSE GENERATOR [GERADOR DE PULSOS DE 4-CANAIS COM ATRASOS AJUSTAVEIS]

L. F. S. Wetzel, J. O. Rossi, and E. DelBosco Feb. 1987 30 p In PORTUGUESE; ENGLISH summary

(INPE-4124-NTE/268) Avail: NTIS HC A03/MF A01

The project of a 4 channel time delayed pulse generator employed to trigger the plasma centrifuge experiment of the Laboratorio Associado de Plasmas is described. The circuit delivers pulses with amplitude of 15 V, full width at half maximum of 50 ms and rise time of 0.7 ms. The maximum time delay is 100 ms. There are two channels with a fine adjustment of 0 to 1 ms. The system can be manually or automatically driven. Author

N87-27926*# National Aeronautics and Space Administration. Pasadena Office, Calif.

SYSTOLIC VLSI ARRAY FOR IMPLEMENTING THE KALMAN FILTER ALGORITHM Patent Application

H. G. Yeh, inventor (to NASA) and J. J. Chang, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 11 Mar. 1987 25 p

(Contract NAS7-918)

(NASA-Case-NPO-17108-1-CU; NAS 1.71:NPO-17108-1-CU; US-Patent-Appl-SN-032819) Avail: NTIS HC A02/MF A01 CSCL 09C

A method and apparatus for processing signals representative of a complex matrix/vector equation is disclosed and claimed. More particularly, signals representing an orderly sequence of the combined matrix and vector equation, known as a Kalman filter algorithm, is processed in real time in accordance with the principles of this invention. The Kalman filter algorithm is converted into a Faddeev algorithm, which is a matrix-only algorithm. The Faddeev algorithm is modified to represent both the matrix and vector portions of the Kalman filter algorithm. The modified Faddeev algorithm is embodied into electrical signals which are applied as inputs to a systolic array processor, which performs triangulation and nullification on the input signals, and delivers an output signal to a real-time utilization circuit. NASA

N87-27927*# National Aeronautics and Space Administration, Washington, D.C.

POTENTIALITIES FOR AN IMPROVEMENT OF THE EFFICIENCY OF FLUORESCENT MERCURY LAMPS

K. Hilpert Sep. 1987 39 p Transl. into ENGLISH of Moeglichkeiten der Verbesserung der Lichausbeute von Niederdruckleuchtsofflampen (Juelich, West Germany, Kernforschungsanlage) p 5-32 Original language document was announced as N79-27425 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-4004)

(NASA-TT-20120; NAS 1.77:20120) Avail: NTIS HC A03/MF A01 CSCL 09A

A Knudsen cell-mass spectrometer system was designed and mounted to study the evaporation rates of mercury amalgam and their application to lamp efficiency improvement. With this instrument the evaporation of the compounds HgMg, Hg2Mg, Hg3Mg5, HgMg2, Hg2Mg5, and HgMg3 as well as of the alloys Hg1-In4-Mg1 was studied after appropriate samples were prepared and characterized. Hg-vapor pressures, reactions of evaporation, and thermodynamic functions are given. Results indicate that at least some of the alloys can be used in lamps. Author

N87-27928# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
FREQUENCY MULTIPLIER FROM 6 TO 12 GHz USING A DUAL GATE GaAs FET [MULTIPLICADOR DE 6 PARA 12 GHz USANDO GaAs FET DUPLA PORTA]
Edson Gusella, Jr. Jul. 1987 12 p In PORTUGUESE; ENGLISH summary Presented at the 5th Brazilian Symposium on Telecommunications, Rio de Janeiro, Brazil, 27-31 Jul. 1987
(INPE-4270-RPE/549) Avail: NTIS HC A02/MF A01

A design method for frequency multipliers was presented using laboratory measurements. The optimum impedance for each access were determined with aid of tunners and then measured with a Vetorial Network Analyzer. With this technique a frequency multiplier from 6 to 12 GHz was designed using the dual gate FET NE463. Author

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N87-27929*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
NUMERICAL SOLUTIONS OF NAVIER-STOKES EQUATIONS FOR A BUTLER WING Final Report, 1 Jan. 1986 - 1 Jan. 1987
Jamshid S. Abolhassani and Surendra N. Tiwari Jan. 1987 32 p (Contract NCC1-68)
(NASA-CR-180331; NAS 1.26:180331) Avail: NTIS HC A03/MF A01 CSCL 20D

The flow field is simulated on the surface of a Butler wing in a uniform stream. Results are presented for the Mach number 3.5 and Reynolds number of 2,000,000. The simulation is done by integrating the viscous Navier-Stokes equations. These equations govern the unsteady, viscous, compressible and heat conducting flow of an ideal gas. The equations are written in curvilinear coordinates so that the wing surface is represented accurately. O-type and H-type grids have been used for this study, and results are compared. The governing equations are solved by the McCormack time-split method, and the results are compared with other theoretical and experimental results. The codes are written in FORTRAN, vectorized and currently run on the CDC Vector Processing System (VPS-32) computer. Author

N87-27930# Calspan Corp., Arnold AFS, Tenn.
CLRCNTR: A COLOR CONTOUR PLOTTING ROUTINE FOR DISPLAYING CFD (COMPUTATIONAL FLUID DYNAMICS)-GENERATED SOLUTIONS Final Report, 1 Oct. 1985 - 30 Sep. 1986
Robert L. Spinetti AEDC Apr. 1987 39 p Prepared for AEDC, Arnold AFS, Tenn.
(AD-A181117; AEDC-TR-86-40) Avail: NTIS HC A03/MF A01 CSCL 20D

A computer program for displaying flow-field color contour plots, generated from computational fluid dynamics (CFD) solutions, has been developed by extending the contour plotting option of the GENPLOT routine of Dr. R. G. Hindman. An algorithm for generating color-filled contour regions was developed for this extension and is described. The algorithm performs a detailed examination of the behavior of the dependent variable within the plotting domain to generate the contour regions and determines the relationship between these regions and their associated contour levels to assign the appropriate fill color to a particular region. Flow-field color contour plots generated from a hypersonic viscous shock-layer computation, a supersonic viscous blunt-fin computation, and a hypersonic viscous gas jet nosetip computation are presented to illustrate the capabilities and flexibility to the routine and to demonstrate that they can be used to aid the interpretation of CFD results. GRA

N87-27931 Maryland Univ., College Park.
AN EXPERIMENTAL INVESTIGATION OF SHOCK WAVES AND TURBULENT BOUNDARY LAYER INTERACTIONS IN A SUPERSONIC FLOWFIELD THROUGH AN ANNULAR DUCT Ph.D. Thesis
Richard Drexel Stockbridge 1986 120 p
Avail: Univ. Microfilms Order No. DA8709465

An experimental investigation of compression fields in a supersonic flow through an annular duct is discussed. A data correlating equation that predicts the starting point of the compression fields in the annular duct as a function of the test variables is derived and evaluated. This correlating equation predicts the minimum length of the isolator duct which conducts air from the external compressor field of a dual combustion ramjet inlet to the supersonic flow combustor that is required to prevent undesirable combustor/inlet interactions. Dissert. Abstr.

N87-27932 Minnesota Univ., Minneapolis.
INTERFACIAL PROBLEMS OF TWO FLUIDS Ph.D. Thesis
Phuong Trong Than 1987 206 p
Avail: Univ. Microfilms Order No. DA8709573

The stability of the two-dimensional flow of a Newtonian liquid coating the inside of a horizontal rotating cylinder is discussed. The linearized stability equations are obtained from the disturbances of the steady rimming flow which itself is analyzed as a regular perturbation from rigid body motion. Experimental results are given which agree with the theory for large Reynold's number. The stability of plane Poiseuille flow of two immiscible liquids of different viscosities and equal densities is also discussed. Regions of stability were found when there are three layers with one of the fluids centrally located. Experiments showed that there is a tendency for the less viscous fluid to encapsulate the more viscous one. Dissert. Abstr.

N87-27933 Wisconsin Univ., Milwaukee.
MODELING THE REYNOLDS STRESS CLOSURE INCORPORATING THE THIRD MOMENTS OF TURBULENCE FOR COMPUTATIONS OF BACKWARD-FACING STEP FLOWS Ph.D. Thesis
Pankaj Goel 1986 137 p
Avail: Univ. Microfilms Order No. DA8708848

A numerical study of computations in backward-facing steps with flow separation and reattachment, using Reynolds stress closure is presented. Comparison of results by the two-equation (kappa-epsilon) model, the original Reynolds Stress Model (RSM) and the Algebraic Stress Model (ASM) is shown. Results obtained by the RSM model are encouraging and therefore model improvement is attempted by using second and third order closures. The highlight of the research is the attempted further improvement of the RSM by modifying the diffusive transport of Reynolds stresses through the formulation, solution and subsequent incorporation of the transport equations of the third movements into the turbulence model. Dissert. Abstr.

N87-27934 Columbia Univ., New York.
THE BOUNDARY INTEGRAL METHOD APPLIED TO A BODY IN A STOKES FLOW NEAR AN INFINITE PLANE Ph.D. Thesis
Philip John Pritchard 1987 238 p
Avail: Univ. Microfilms Order No. DA8710218

A boundary integral method is described in which the surface tractions on a body in a viscous flow near an infinite plane are obtained. The method uses a singular solution for a point force in a viscous fluid near the infinite plane. The body is represented by a distribution of the singular solution over its surface, and the density of this distribution is also the magnitude of the surface tractions. This approach leads to an integral equation for the unknown surface tractions, in terms of body shape and orientation with respect to the plane, and the prescribed velocity at the particle surface. Dissert. Abstr.

N87-27935 Virginia Univ., Charlottesville.
A STREAMLINE UPWIND FINITE ELEMENT METHOD FOR LAMINAR AND TURBULENT FLOW Ph.D. Thesis
Rita Jane Schnipke 1986 230 p
Avail: Univ. Microfilms Order No. DA8705675

A finite element method was developed for the analysis of steady state, two-dimensional viscous fluid flow. The method is capable of predicting both laminar and turbulent flows in complex geometries. It also facilitates application of boundary conditions. A streamline upwind approximation is developed for representing the advection terms in the governing transport equations. A new velocity-pressure solution algorithm is also proposed.
Dissert. Abstr.

N87-27936*# Georgia Inst. of Tech., Atlanta. School of Mechanical Engineering.
MODELING OF TRANSIENT HEAT PIPE OPERATION Semiannual Status Report, 19 Aug. 1986 - 18 Feb. 1987
Gene T. Colwell 1 Jul. 1987 36 p
(Grant NAG1-392)
(NASA-CR-180280; NAS 1.26:180280) Avail: NTIS HC A03/MF A01 CSCL 20D

The use of heat pipes is being considered as a means of reducing the peak temperature and large thermal gradients at the leading edges of reentry vehicles and hypersonic aircraft and in nuclear reactors. In the basic cooling concept, the heat pipe covers the leading edge, a portion of the lower wing surface, and a portion of the upper wing surface. Aerodynamic heat is mainly absorbed at the leading edge and transported through the heat pipe to the upper and lower wing surface, where it is rejected by thermal radiation and convection. Basic governing equations are written to determine the startup, transient, and steady state performance of a haet pipe which has initially frozen alkali-metal as the working fluid. Author

N87-27937# Lawrence Livermore National Lab., Calif.
PSEUDOSPECTRAL COMPUTATIONS ILLUSTRATING SHOCK WAVE TURBULENCE AMPLIFICATION IN VISCOUS FLOW
A. C. Buckingham Mar. 1987 13 p Presented at the Numerical Methods in Laminar and Turbulent Flow Conference, Montreal, Quebec, 6 Jul. 1987
(Contract W-7405-eng-48)
(DE87-008493; UCRL-95512; CONF-870712-2) Avail: NTIS HC A02/MF A01

Pre-existing turbulence may be significantly amplified by shock waves. Qualitative confirmation exists from shock tube and supersonic wind tunnel shock wave boundary layer interaction experiments. The former rarely provide accurate quantitative data, since probe survival and resolution sensitivity are jeopardized by shock pressure, temperature, and brevity of measurement duration. The latter, shock boundary layer interaction experiments, are extremely difficult to interpret since the process is obscured by the complex flow structure, the general turbulence questions, and the ill-defined interaction. Detailed numerical simulations are sought to provide verification and isolate dominant mechanisms. In the present work, pseudospectral Navier-Stokes simulations are developed which either capture the shock or track and fit it as a moving computational boundary. DOE

N87-27938# Los Alamos National Lab., N. Mex.
CAVEAT CALCULATIONS OF SHOCK INTERACTIONS
D. L. Sandoval Jun. 1987 55 p
(Contract W-7405-eng-36)
(DE87-010838; LA-11001-MS) Avail: NTIS HC A04/MF A01

CAVEAT is a computer code for calculating the time-varying fluid dynamics of several adjacent materials in two or three space dimensions. Using an extended Godunov technique and adaptive meshing, the code allows for large slippage at material interfaces. To exhibit the capability for calculating strong distortions a variety of calculations has been performed describing the interaction of shocks with rigid wedges, cylinders, and spheres and deformable cylindrical, spherical, and conical shells in two space dimensions. Comparison of the results with experimental data and analytical solutions demonstrates the considerable accuracy that can be expected from calculations with this code. DOE

N87-27939# European Space Agency, Paris (France).
NUMERICAL SIMULATION OF ACTIVE CONTROL OF LAMINAR-TURBULENT TRANSITION IN THE FLAT-PLATE BOUNDARY LAYER
Eckardt Laurien Jan. 1987 124 p Transl. into ENGLISH of Numerische Simulation zur Aktiven Beeinflussung des Laminar-Turbulenten Uebergangs in des Plattengrenzschicht-stroemung (Goettingen, West Germany, DFVLR), Jan 1986 Original language document was announced as N86-31852
(ESA-TT-995; DFVLR-FB-86-05; ETN-87-90005) Avail: NTIS HC A06/MF A01; original German version available from DFVLR, Cologne, West Germany DM 36

Laminar-turbulent transition in the flat-plate boundary layer was simulated starting from Tollmein-Schlichting waves. Using the spatially periodic simulation model, the three-dimensional incompressible Navier-Stokes equations were solved by a spectral method. For the direction normal to the wall a Chebyshev collocation method was developed. The classical Klebanoff type and the subharmonic type were simulated. Up to the spike stage the results agree well with hot-wire measurements. The transition can be actively delayed by local two-dimensional suction blowing, if it is applied in the early stages. ESA

N87-27940# European Space Agency, Paris (France).
EXPERIMENTAL INVESTIGATION OF NOISE GENERATED BY TURBULENCE IN A PIPE FLOW BEHIND A DISCONTINUOUS AREA ENLARGEMENT
Bernhard Stahl Jan. 1987 198 p Transl. into ENGLISH of Experimenteller Beitrag zur Schallerzeugung Durch die Turbulenz in einer Rohrstroemung Hinter einer Unstetigen Qyerschnittser-weiterung (Goettingen, West Germany, DFVLR), Nov. 1985 Original language document was announced as N86-31853
(ESA-TT-996; DFVLR-FB-86-06; ETN-87-90006) Avail: NTIS HC A09/MF A01; original German version available from DFVLR, Cologne, West Germany DM 36.50

Plane sound waves and higher acoustic modes, generated by turbulence occurring in the flow separation region downstream of a discontinuous enlargement in the circular cross-sectional area of a pipe, were investigated. Measurements of the axial phase velocity of pressure fluctuations show that turbulence fluctuations dominate in the region of flow separation just behind the jump in cross-sectional area, whereas further downstream the field is primarily determined by fluctuations of the aerodynamically generated sound waves. A decomposition of the pressure fluctuations shows that in the mixing region of the jet, the fluctuation energy is primarily distributed among several azimuthal components, while further downstream almost all the energy in the frequency range below the cut-off frequency of the first higher-order mode is concentrated in the axially symmetric component. ESA

N87-27941# European Space Agency, Paris (France).
NUMERICAL SIMULATION OF A HOMOGENEOUS INCOMPRESSIBLE TURBULENT FIELD WITH MEAN VELOCITY GRADIENTS
Philippe Roy Mar. 1987 240 p Transl. into ENGLISH of Simulation Numerique d'un Champ Turbulent Homogene Incompressible Soumis a des Gradients de Vitesse Moyenne (Paris, France, ONERA), 1986 Original language document was announced as N87-13703 Original contains color illustrations
(ESA-TT-1022; ONERA-NT-1986-1; ETN-87-90016) Avail: NTIS HC A11/MF A01

A formulation which can simulate all mean velocity gradients in a turbulent flow field is introduced. Methods for estimating and minimizing numerical anisotropy errors are suggested. The computerized simulation results are detailed, including two mean gradient cases: plane strain and rotation. A transition appears

between two and three dimensional turbulence in a enhanced spectral domain of influence for rotation. ESA

N87-27942# Ecole Nationale Superieure de l'Aeronautique, Toulouse (France).
STUDY OF THE UNSTEADY FLOW IN AXIAL COMPRESSORS [ETUDES DU FONCTIONNEMENT NON STATIONNAIRE DES COMPRESSEURS AXIAUX]
Berger and Alain Carrere 30 Mar. 1987 52 p In FRENCH
(Contract DRET-84/1454)
(ETN-87-90133) Avail: NTIS HC A04/MF A01

The axisymmetric flow in axial compressors was studied and characterized using experimental methods. A compression bench implemented with two transonic stages was used. The inlet flow and the steady compressor flow were measured. Unsteady flow measurements were carried out to characterize the system near the pumping limit. The results were compared to compressor stability computation procedure data. The comparison validates the numerical analysis. ESA

N87-27943*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
EXPERIMENTAL AND ANALYTICAL STUDIES IN FLUIDS Final Report, period ending 31 Aug. 1984
Gene L. Goglia and Adel Ibrahim Sep. 1984 101 p
(Grant NsG-1177)
(NASA-CR-181242; NAS 1.26:181242) Avail: NTIS HC
A06/MF A01 CSCL 20D

The first objective was to analyze and design a true airspeed sensor which will replace the conventional pitot-static pressure transducer for small commercial aircraft. The second objective was to obtain a numerical solution and predict the frequency response which is generated by the vortex whistle at a certain airspeed. It was concluded flow rate measurements indicate that the vortex tube sound frequency is linearly proportional to the frequency response. The vortex tube whistle frequency is dependent upon geometrical parameters to such an extent that: an increase in vortex tube length produces a decrease in frequency response and that an increase in the exhaust nozzle length produces an increase in the frequency precession. An increase in the vortex tube diameter produces a decrease in frequency precession. An increase in swirler diameter produces a decrease in frequency. An increase in the location distance of the microphone pickup signal point from the inside edge of the exit nozzle produces an increase in frequency response. The experimental results indicate that those parameters most significantly effecting frequency are in descending order of importance microphone location, vortex tube diameter, exit nozzle length, vortex tube length, and swirler diameter. B.G.

N87-27944*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering Technology.
COMPUTATION OF DESIGN PARAMETERS AND VISUALIZATION OF GOERTLER VORTICES Final Report, 16 Feb. 1983 - 15 Feb. 1984
Alok K. Verma Apr. 1984 27 p
(Grant NAG1-340)
(NASA-CR-181246; NAS 1.26:181246) Avail: NTIS HC
A03/MF A01 CSCL 20D

A method for analyzing an airfoil regarding Goertler type instability was presented. A model for the visualizatin of Goertler vortices was designed and fabricated. A smoke generating apparatus was made to be used in the experiment. Experiments were conducted to photograph the vortices, however, the smoke generated was not enough to bring out the vortices. Author

N87-27945*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
SURFACE-SLIP EQUATIONS FOR MULTICOMPONENT, NONEQUILIBRIUM AIR FLOW Final Report, period ending 30 Sep. 1984
Roop N. Gupta, Carl D. Scott, James N. Moss, and Gene Goglia Apr. 1985 97 p
(Grant NAG1-346)
(NASA-CR-181252; NAS 1.26:181252) Avail: NTIS HC
A05/MF A01 CSCL 20D

Equations are presented for the surface slip (or jump) values of species concentration, pressure, velocity, and temperature in the low-Reynolds-number, high-altitude flight regime of a space vehicle. These are obtained from closed-form solutions of the mass, momentum, and energy flux equations using the Chapman-Enskog velocity distribution function. This function represents a solution of the Boltzmann equation in the Navier-Stokes approximation. The analysis, obtained for nonequilibrium multicomponent air flow, includes the finite-rate surface catalytic recombination and changes in the internal energy during reflection from the surface. Expressions for the various slip quantities have been obtained in a form which can readily be employed in flow-field computations. A consistent set of equations is provided for multicomponent, binary, and single species mixtures. Expression is also provided for the finite-rate species-concentration boundary condition for a multicomponent mixture in absence of slip. Author

N87-27946*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
EXPERIMENTAL STUDIES ON TAYLOR-GOERTLER VORTICES Final Report, 1 May 1984 - 28 Feb. 1985
G. L. Goglia and S. M. Mangalam Feb. 1985 19 p
(Grant NAG1-353)
(NASA-CR-181254; NAS 1.26:181254) Avail: NTIS HC
A02/MF A01 CSCL 20D

Taylor-Goertler vortices arise in boundary layer along concave surfaces due to centrifugal effects. These counter-rotating streamwise vortices are one of three known flow instabilities which lead to boundary layer transition. Coupled with Tollmien-Schlichting waves and cross flow vortices, Taylor-Goertler vortices can triggerr early transition to turbulence. The flow field patterns were studied by flow visualization using a sublimating chemical technique and a three component laser velocimeter was used to study the flow field in the test region. Results from these studies are given and briefly discussed. Author

N87-27947*# Tennessee Univ. Space Inst., Tullahoma.
NONLINEAR ACOUSTIC WAVE PROPAGATION IN ATMOSPHERE. ABSORBING BOUNDARY CONDITIONS FOR EXTERIOR PROBLEMS Semiannual Status Report, 1 Nov. 1984 - 30 Apr. 1985
S. I. Hariharan 1985 35 p Presented at the course Numerical Methods for Partial Differential Equations, Tullahoma, Tenn., 18-22 Mar. 1985
(Grant NAG1-527)
(NASA-CR-181260; NAS 1.26:181260) Avail: NTIS HC
A03/MF A01 CSCL 20D

Elliptic and hyperbolic problems in unbounded regions are considered. These problems, when one wants to solve them numerically, have the difficulty of prescribing boundary conditions at infinity. Computationally, one needs a finite region in which to solve these problems. The corresponding conditions at infinity imposed on the finite distance boundaries should dictate the boundary conditions at infinity and be accurate with respect to the interior numerical scheme. The treatment of these boundary conditions for wave-like equations is discussed. Author

N87-27948*# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
FREE VORTICITY FIELD-BOUNDARY LAYER CONVERSIONS: EFFECT OF BOUNDARY CONFIGURATION AND SCALE Progress Report
D. Rockwell, D. Sohn, and I. Gursul Sep. 1985 18 p
(Grant NAG1-461)
(NASA-CR-181265; NAS 1.26:181265) Avail: NTIS HC
A02/MF A01 CSCL 20D

Progress was made on further flow visualization of vortex-leading edge interaction, in conjunction with characterization of the unsteady pressure field. The range of scale of an elliptical leading edge, relative to the incident primary vortex, was

determined. The scale of the incident vortex was characterized in terms of mean shear layer parameters. An overview of the interaction mechanism for the range of thin to thick leading-edges is given. The interaction mechanism corresponding to the case where the incident vortex is above the leading-edge is given for hydrogen bubble wires well upstream of and at the tip of the leading edge. A sample of the instantaneous pressure distribution for the case where the incident vortex dives beneath the edge is presented. The effect of scale of the incident vortex relative to that of the leading-edge was examined. The circulation and length scale of the incident vortices in the street are being characterized. B.G.

N87-27949*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
STUDIES OF UNSTEADY VISCOUS FLOWS USING A TWO-EQUATION MODEL OF TURBULENCE Semiannual Status Report, 1 Jan. - 30 Jun. 1987
L. N. Sankar and Jiunn-chi Wu 1987 11 p
(Grant NAG3-768)
(NASA-CR-181293; NAS 1.26:181293) Avail: NTIS HC A02/MF A01 CSCL 20D

A two equation model of turbulence, based on the turbulent kinetic energy and energy dissipation, suitable for prediction of unsteady viscous flows, was developed. Also, the performance of the two equation model was compared with simpler algebraic models such as the Baldwin-Lomax two layer eddy viscosity model, and a model by Johnson and King which accounts for upstream history of the turbulent kinetic energy. A brief discussion of this study is given. Author

N87-27950# Los Alamos National Lab., N. Mex.
ANALYTICAL AND NUMERICAL SOLUTION OF ONE- AND TWO-DIMENSIONAL STEADY HEAT TRANSFER IN A COLDPLATE
G. F. Jones, G. A. Bennett, and D. H. Bultman 1987 12 p Presented at the 22nd AIAA Thermophysics Conference, Honolulu, Hawaii, 8 Jun. 1987 Previously announced as A87-43114
(Contract W-7405-eng-36)
(DE87-010128; LA-UR-87-1737; CONF-870623-8) Avail: NTIS HC A02

We develop analytical models for steady-state, one- and two-dimensional heat transfer in a single-material, flat-plate coldplate. Discrete heat sources are mounted on one side of the plate and heat transfer to a flowing fluid occurs on the other. The models are validated numerically using finite differences. We propose a simple procedure for estimating maximum coldplate temperature at the location of each heat source which includes thermal interaction among the sources. Results from one model are compared with data obtained for a composite coldplate operated in the laboratory. We demonstrate the utility of the models as diagnostic tools to be used for predicting the existence and extent of void volumes and delaminations in the composite material that can occur with coldplates of this type. Based on our findings, recommendations for effective coldplate design are given. DOE

N87-27951# Argonne National Lab., Ill.
DYNAMIC BEHAVIOR OF REACTING GAS JETS SUBMERGED IN LIQUIDS
D. H. Cho, D. R. Armstrong, and L. Bova 1987 9 p Presented at the Thermal Hydraulics of Severe Nuclear Reactor Accidents/National Heat Transfer Conference Joint Conference, Pittsburgh, Pa., 9 Aug. 1987
(Contract W-31-109-eng-38)
(DE87-011397; CONF-870816-22) Avail: NTIS HC A02

A photographic study of a hydrogen chloride gas jet reacting in an aqueous solution of ammonia was conducted. The high-speed motion pictures taken revealed that the behavior of the reacting gas jet was highly dynamic and complex. The gaseous jet penetration (plume) was not stationary, but underwent a change in shape and size with time, which appeared to be periodic or cyclic. Such dynamic plume behavior is attributed to the vaporization of ammonia due to reaction heat release. In fact, the overall plume behavior resembled that of a subsonic vapor jet condensing in liquid. The plume length measurements for large concentrations of ammonia seem to confirm the prediction that when the extent of vaporization is large, the plume length is mainly determined by the distance required for condensation of the ammonia vapor. DOE

N87-27952# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
MODELING OF TIME-VARIANT FLOWS USING VORTEX DYNAMICS. ACTIVITIES IN THE NETHERLANDS
H. W. M. Hoeijmakers 10 Apr. 1986 13 p Presented at the AGARD Fluid Dynamics Panel Round Table Discussion on Modeling of Time-Variant Flows using Vortex Dynamics, Aix-en-Provence, France, 10 Apr. 1986
(NLR-MP-86028-U; B8701676; ETN-87-90186) Avail: NTIS HC A02/MF A01

Vortex methods for simulating low speed flows are reviewed. Methods for flow around bluff bodies with vortex shedding; the evolution of wakes; and prediction of the aerodynamic characteristics of oscillating wings with leading edge vortex separation are discussed. ESA

N87-27953# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
COMPUTATION OF THE SEPARATION OF STEADY AND UNSTEADY, INCOMPRESSIBLE, LAMINAR BOUNDARY LAYERS
R. A. W. M. Henkes Nov. 1985 212 p
(VTH-LR-483; B8707456; ETN-87-90222) Avail: NTIS HC A10/MF A01

The unsteady interacting boundary layer equations are integrated, and the effect on finite time singularities is investigated. It is shown that the unsteady interacting boundary layer description delays the appearance of the finite time singularity in the unsteady classical boundary layer solution of the impulsively started cylinder. The breakdown of the interacting solution is characterized by the unlimited growth of a peak in the displacement thickness, but the used meshsize and timestep are too small to decide whether its growth is singular at a finite time or only leads to an unbounded solution for t tends to infinity. The interacting solution for R = 100,000 shows the individualization of a vortex, which is not calculated in the classical solution. It is suggested that the finite time singularity in the classical solution is related to this rapidly growing vortex, which seems to characterize the violently unsteady transition of an unsteady attached flow layer close to the wall to an unsteady detached flow. ESA

N87-27954# Karlsruhe Univ. (West Germany). Sonderforschungsbereich.
WIND TUNNEL EXPERIMENTS ON COOLING TOWER PLUMES. PART 2: IN NONUNIFORM CROSS FLOW OF BOUNDARY LAYER TYPE
Jannis Andreopoulous Jan. 1986 62 p Sponsored by Deutsche Forzchungsgeimschaft
(KU-SFB-210/E/19-Pt-2; ETN-87-90369) Avail: NTIS HC A04/MF A01

Plumes issuing into a boundary layer were studied. The large eddies of the oncoming boundary layer are responsible for sudden changes in plume direction. The type of eddy structure depends on the velocity ratio at that moment. Mean velocities and normal velocity gradients are smaller than in the case of uniform crossflow and the measured turbulence intensities are lower too. The cross-stream turbulence brings high momentum fluid into the wake region and the velocity defect decays very rapidly. Plume dilution is faster in the presence of external turbulence than with uniform cross-flow. The spreading rate is increased dramatically by the external turbulence which causes different effects on the hydrodynamic and thermal fields. ESA

N87-27955# Karlsruhe Univ. (West Germany). Sonderforschungsbereich.
DEVELOPMENT OF A FINITE VOLUME PROCEDURE FOR PREDICTION OF FLUID FLOW PROBLEMS WITH COMPLEX IRREGULAR BOUNDARIES
S. Majumdar Dec. 1986 74 p
(KU-SFB-210/T/29; ETN-87-90371) Avail: NTIS HC A04/MF A01

A finite volume procedure for prediction of steady two-dimensional flow in general nonorthogonal coordinates using a nonstaggered variable arrangement was developed. The derivation of cross derivative diffusion and pressure terms and their explicit treatment as pseudo-source terms are adequate for grids with mild nonorthogonality. The convergence is, however, slowed down with increased nonorthogonality. The consistency of assumption of linear variation of pressure between nodes against the momentum interpolation for cell-face velocities can not be assessed from the results on a limited number of test cases.
ESA

N87-27956*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A WELL-POSED OPTIMAL SPECTRAL ELEMENT APPROXIMATION FOR THE STOKES PROBLEM Final Report
Y. Maday, A. T. Patera, and E. M. Ronquist (Massachusetts Inst. of Tech., Cambridge.) Jul. 1987 46 p Submitted for publication
(Contracts NAS1-18107; N00014-82-K-0208)
(NASA-CR-178343; ICASE-87-48; NAS 1.26:178343) Avail: NTIS HC A03/MF A01 CSCL 20D

A method is proposed for the spectral element simulation of incompressible flow. This method constitutes in a well-posed optimal approximation of the steady Stokes problem with no spurious modes in the pressure. The resulting method is analyzed, and numerical results are presented for a model problem.
Author

N87-27957*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MODIFICATION TO THE LANGLEY 8-FOOT HIGH TEMPERATURE TUNNEL FOR HYPERSONIC PROPULSION TESTING
D. E. Reubush, R. L. Puster, and H. N. Kelly Jun. 1987 13 p Presented at the AIAA/SAE/ASME 23rd Joint Propulsion Conference, San Diego, Calif., 29 Jun. - 2 Jul. 1987
(NASA-TM-100486; NAS 1.15:100486; AIAA-87-1887) Avail: NTIS HC A02/MF A01 CSCL 20D

Described are the modifications currently under way to the Langley 8-Foot High Temperature Tunnel to produce a new, unique national resource for testing hypersonic air-breathing propulsion systems. The current tunnel, which has been used for aerothermal loads and structures research since its inception, is being modified with the addition of a LOX system to bring the oxygen content of the test medium up to that of air, the addition of alternate Mach number capability (4 and 5) to augment the current M=7 capability, improvements to the tunnel hardware to reduce maintenance downtime, the addition of a hydrogen system to allow the testing of hydrogen powered engines, and a new data system to increase both the quantity and quality of the data obtained. Author

N87-27958# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Fluid Dynamics Panel.
TECHNICAL EVALUATION REPORT ON THE FLUID DYNAMICS PANEL SYMPOSIUM ON APPLICATIONS OF COMPUTATIONAL FLUID DYNAMICS IN AERONAUTICS
W. J. McCroskey (National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.) Mar. 1987 24 p Symposium held in Aix-en-Provence, France, 7-10 Apr. 1986
(AD-A172209; AGARD-AR-240; ISBN-92-835-0416-X) Copyright Avail: NTIS HC A02/MF A01

The Fluid Dynamics Panel of AGARD arranged a Symposium in Applications of Computational Fluid Dynamics in Aeronautics on 7-10 April 1986 in Aix-en-Provence, France. The purpose of the Symposium was to provide an assessment of the status of CFD in aerodynamic design and analysis, with an emphasis on emerging applications of advanced computational techniques to complex configurations. Sessions were devoted specifically to grid generation, methods for inviscid flows, calculations of viscous-inviscid interactions, and methods for solving the Navier-Stokes equations. The 31 papers presented at the meeting are published in AGARD Conference Proceedings CP-412 and are listed in the Appendix to this report. A brief synopsis of each paper and some general conclusions and recommendations are given. Author

N87-27959# Howard Univ., Washington, D. C. Dept. of Mechanical Engineering.
FINITE DIFFERENCE ANALYSIS OF NATURAL CONVECTION ABOUT A HORIZONTAL SQUARE ROD IN A CYLINDRICAL ENCLOSURE
E. K. Glakpe Jul. 1986 103 p
(Contract DE-FG05-84OR-21495)
(DE87-009956; DOE/OR-21495/T1) Avail: NTIS HC A06/MF A01

Natural convection heat transfer from a body to a finite space surrounding it has received extensive attention in recent years. Application areas include the design of nuclear reactors, the design of spent fuel casks, the cooling of electronic equipment, heat transfer in aircraft cabin insulation systems, and thermal storage systems. Both numerical and experimental studies have been made on natural convection heat transfer about relatively simple, but not necessarily easy, flow configurations for which convenient natural coordinate systems exist. However, very few studies of natural convection in and around complex geometries have been made. The present methodology can be applied to a class of natural convection problems in a horizontal circular enclosure where the inner boundary does not lie along a coordinate line. The results obtained with the present method for a concentric cylinders' problem are in good agreement with previous results. The present results are applicable only to a dry cask. However, by changing the Prandtl number, results for fluids other than air can be obtained. The present methodology is limited to two but can be extended easily to three dimensions. DOE

N87-27960# Sandia National Labs., Albuquerque, N. Mex.
AN ANALYTICAL MODEL FOR RAYLEIGH-TAYLOR INSTABILITY IN SOLIDS
A. C. Robinson 1987 4 p Presented at the 5th Topical Conference of the American Physical Society on Shockwaves in Condensed Matter, Monterey, Calif., 20 Jul. 1987
(Contract DE-AC04-76DP-00789)
(DE87-011064; SAND-87-0765C; CONF-870753-2) Avail: NTIS HC A02/MF A01

The model equations described in this paper are able to reproduce the qualitative behavior of the elastic-plastic Rayleigh-Taylor instability response seen in numerical experiments. Both elastic shear modulus and yield strength play important roles in the response characteristics. For low driving pressures a critical amplitude stability criterion may be appropriate. For sustained high pressure this rule will not be sufficient as there will exist wavelengths on the order of the plate thickness. DOE

N87-27961*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE GROWTH OF GOERTLER VORTICES IN COMPRESSIBLE BOUNDARY LAYERS Final Report
Philip Hall and Mujeeb R. Malik Aug. 1987 26 p Submitted for publication
(Contract NAS1-18107)
(NASA-CR-178360; ICASE-87-46; NAS 1.26:178360) Avail: NTIS HC A03/MF A01 CSCL 20D

The linear instability of Goertler vortices in compressible boundary layers is considered. Using asymptotic methods in the high wavenumber regime, it is shown that a growth rate estimate can be found by solving a sequence of linear equations. The growth rate obtained in this way takes non-parallel effects into

account and can be found much more easily than by ordinary differential equation eigenvalue calculations associated with parallel flow theories. Author

N87-27962# Los Alamos National Lab., N. Mex.
A GENERALIZED MAC METHOD FOR INCOMPRESSIBLE FLUID FLOW
Nov. 1986 27 p
(Contract W-7405-eng-36)
(LA-10853-MS) Avail: NTIS HC A03/MF A01

A scheme for obtaining numerical solutions to the time-dependent incompressible fluid flow equations is presented. The method is designed for use on a computational grid of arbitrary polygons, and can be considered to be the Finite-Volume (FV) generalization of the Marker-and-Cell (MAC) method. A scheme resembling the advection method of van Leer is utilized in a way that yields second-order spatial accuracy and conditional stability with any level of fluid viscosity. The method is fully described in the presentation. Sample results are given for a variety of two-dimensional flow circumstances. These include non-viscous, viscous, steady, and unsteady flows on various non-orthogonal computational meshes. Author

N87-27963# Los Alamos National Lab., N. Mex.
EQUIVALENT 1-DIMENSIONAL HYDRODYNAMIC DISPERSION IN A TUBE WITH RADIOACTIVE DECAY AND ADSORPTION
Ilya Partom and Mabel Grey Oct. 1986 17 p
(W-7405-eng-36)
(LA-10861-MS) Avail: NTIS HC A02/MF A01

The equivalent 1-D coefficient of hydrodynamic dispersion in a circular tube was reported earlier. In this report, those computations are extended and also include radioactive decay and chemical adsorption. Breakthrough curves from 1-D and 2-D computations are compared and it is found that the equivalent coefficient of dispersion obtained for pure hydrodynamic dispersion is also good when radioactive decay and chemical adsorption take place. Author

N87-27964# Nielsen Engineering and Research, Inc., Mountain View, Calif.
SPRAY FORMATION: 3D LIQUID BREAKUP DUE TO SURFACE TENSION Annual Technical Report, 1 Apr. 1986 - 31 Mar. 1987
Robert E. Childs and Nagi N. Mansour 11 May 1987 6 p
(Contract F49620-86-C-0062)
(AD-A181927; AFOSR-87-0820TR) Avail: NTIS HC A02/MF A01 CSCL 20D

The objective of the work was the investigation of fluid dynamic and surface tension instabilities that effect the breakup of fuel jets in the atomization process. Computational and analytical methods were used. Initial work involved the evaluation of numerical methods for flows with density discontinuities. It was discovered that many commonly used methods are poorly suited to predicting two phase flows. However, a suitable method was found, and it was programmed in a Navier-Stokes prediction code. The code has passed some accuracy tests, and others are ongoing. Predictions of simple one and two phase flows were conducted as part of these tests. A method for computing surface tension effects was included in the prediction algorithm, but further work is ongoing to make the method more robust. Inviscid stability analysis of an expanding-radius liquid tubular jet was performed. It was found that no new instability mechanisms are introduced by the rate of change of radius. A viscous stability analysis of a shear layer with a discontinuity in density was initiated and will be continued. GRA

N87-27965# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
COUPLING BETWEEN RADIATION AND GAS DYNAMICS Annual Report, 1 Dec. 1985 - 1 Feb. 1987
Charles L. Merkle 31 Mar. 1987 38 p
(Grant AF-AFOSR-0048-84)
(AD-A181951; AFOSR-87-0844TR) Avail: NTIS HC A03/MF A01 CSCL 20D

Direct heat addition of flowing gases by radiation absorption is considered. In the Infrared regime, the coupling between a laser beam and a flowing gas is being modeled numerically. Implicit time iterative procedures originally developed for transonic flows are being adapted to the low Mach number, low Reynolds number regimes of interest. Two dimensional solutions show that absorption plasmas can exist over a wide range of flow speeds and that buoyancy can be a dominant factor when the forced convection velocity is small. In the microwave regime, an experimental investigation of various absorption modes is underway. An overview of the experimental design and initial experimental results is presented. Numerical predictions of the resonant cavity and propagating plasma modes of microwave absorption are also discussed. GRA

N87-27966# Texas Univ., Austin. Dept. of Physics.
SYMMETRY BREADING BIFURCATIONS AND THE GROWTH OF CHAOS IN A ROTATING FLUID Annual Report, 1 Jun. - 31 Dec. 1986
Harry L. Swinney 1 May 1987 5 p
(Contract N00014-86-K-0385)
(AD-A182163; TR-87-1) Avail: NTIS HC A02/MF A01 CSCL 20D

Bifurcations in flow between independently rotating circular cylinders are being investigated experimentally, numerically, and theoretically. A nonlinear stability analysis of the primary instability exploits symmetry properties to make predictions about the form of the secondary flows; the predictions for the critical Reynolds numbers, wavespeeds, and wavenumbers of the secondary flows (spirals, ribbons, and Taylor vortices) are in good accord with experiment. In another area of study, measurements of mass transport at high Reynolds numbers show that transport in the axial direction is well-described by an effective diffusion coefficient D that has an exponential dependence on the Reynolds number R, D proportional to R to the 3/4 power, while theory suggests that the exponent should be 1 instead of 3/4. GRA

N87-27967# Naval Ocean Systems Center, San Diego, Calif.
FLAT PLATE REDUCTION IN A WATER TUNNEL USING RIBLETS Final Report, Oct. 1985 - Sep. 1986
L. W. Reidy May 1987 22 p
(AD-A182242; NOSC/TR-1169) Avail: NTIS HC A02/MF A01 CSCL 19D

Streamwise microgroove surface modifications, known as riblets, are known to alter the structure of the turbulent boundary layer such that the skin friction drag over the surface is reduced. For this investigation, velocity profile measurements were used to calculate the drag on a flat plate, both with and without riblets, in a high-speed water tunnel. The vinyl riblet surface produced a maximum drag reduction of 8.1% + or - 2.5% at a nondimensional groove spacing of + or - 13.1. If the results obtained in the laboratory can be realized for torpedoes and other submersibles, significant improvements in vehicle speed or fuel economy will be achieved. GRA

N87-27968# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
EXPERIMENTAL INVESTIGATION OF TURBULENT FLOW FIELD AND PRESSURE FLUCTUATIONS ON FLAT SURFACES AND CYLINDERS Final Report, 1 Jan. 1976 - 31 Dec. 1985
William W. Willmarth 30 Jun. 1987 23 p
(Contract N00014-76-C-0571)
(AD-A182305) Avail: NTIS HC A02/MF A01 CSCL 20D

The structure of the fluctuating flow field in a turbulent boundary layer is investigated with the aid of extremely small hot wire probes. Two investigations were conducted. In the first a small X array hot-wire probe, with dimensions (length and spacing) of the order of 2.5 viscous lengths (100 microns) was constructed and used to measure the small scale structure of the velocity fluctuations and the Reynolds stress near the wall. It was found that very small, intense contributions to the Reynolds stress occur with a

scale of the order of the viscous length. In the other investigation a pair of single hot-wires which were of a length of the order of one half the viscous length (50 Microns) was used to demonstrate the existence of shear layers near the wall with an intensity comparable to the mean shear stress at the wall. One primary result is when large scale turbulence is present in the flow upstream of the cylinder, large amplitude, low frequency circumferentially averaged pressure fluctuations are caused by pressure fluctuations in the free stream turbulence and by the dynamic interaction of cylinder with the free stream turbulence. A three-sensor hot-wire probe was used to measure the three components of the velocity fluctuations in the free stream at a point 3.5 diameters from the axis of the cylinder. GRA

N87-27969# Naval Research Lab., Washington, D.C.
SUBMERGED STRUCTURAL RESPONSE TO WEAK SHOCK BY COUPLED THREE-DIMENSIONAL RETARDED POTENTIAL FLUID ANALYSIS-FINITE ELEMENT STRUCTURAL ANALYSIS Final Report, Oct. 1983 - Sep. 1984
Martin A. Tamm and Waylon W. Webbon 21 May 1987 36 p
(AD-A182320; NRL-MR-5903) Avail: NTIS HC A03/MF A01 CSCL 13M

The discretized Kirchhoff retarded potential integral equation for solving the linear acoustic wave equation is coupled to a general finite element structural analysis code to model underwater vibrations. Arbitrary three dimensional problems can be handled, with a present restriction on the allowed orientation of the finite element grid lines and the requirement of a plane wave form. Ramp and Fourier series approximations to a step wave are applied to rigid and elastic spheres to test the numerical formulation, and to test the validity of using a continuous approximation to a discontinuous loading. GRA

N87-27970# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
TO ENHANCE THE CAPABILITY AND INCREASE THE PRODUCTIVITY OF A GROUP WORKING ON CRITICAL PROBLEMS OF HIGH SPEED FLUID MECHANICS - BOTH EXPERIMENTALLY AND THROUGH NUMERICAL CALCULATIONS Final Report, 1 Sep. 1983 - 31 Mar. 1986
Seymour M. Bogdonoff 22 May 1987 14 p
(Grant AF-AFOSR-0360-83)
(AD-A182559; MAE-1753; AFOSR-87-0793TR) Avail: NTIS HC A02/MF A01 CSCL 20D

A new test channel has been designed and constructed to operate off the present high pressure air supply. The new facility is characterized by low turbulence, variable geometry (LTVG) , and supersonic operation (currently designed for Mach 3) at stagnation pressures from 50 to 150 psia. This facility provides a new and unique capability to study two- and three-dimensional supersonic turbulent boundary layers interacting with gradients and shock waves. A new and enhanced data acquisition processing system has been installed in the Laboratory. It is based on the DEC VAX-750 which provides multi-channel high frequency, data acquisition and data processing capability for all of the Laboratory facilities. GRA

N87-27971# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SIMULATED HEAT-PIPE VAPOR DYNAMICS Ph.D. Thesis
W. J. Bowman May 1987 242 p
(AD-A182592; AFIT/DS/ENY/87) Avail: NTIS HC A11/MF A01 CSCL 20M

This dissertation describes work done to establish functional relationships for friction coefficients that can be used in simple, one-dimensional heat-pipe vapor models. Expressions for friction coefficients were derived that can be used to design heat pipes for compressible-flow situations (Mach numbers as high as one) with very large mass injection/extraction rates (radial Reynolds numbers ranging from tor-100 to tor-20,000). In order to establish these relationships, a simulated heat pipe was studied. Pressure variations axially and velocity variations axially and radially along the simulated heat pipe were experimentally measured. Turbulent transition in the heat pipe was also experimentally studied. The experimental data was used to show that numerical solutions gave valid results. GRA

N87-27972# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
INVESTIGATION OF HEAT TRANSFER TO A SHARP EDGED FLAT PLATE USING A SHOCK TUBE M.S. Thesis
Bret J. Smith Dec. 1986 108 p
(AD-A182595; AFIT/GAE/AA/86D-16) Avail: NTIS HC A06/MF A01 CSCL 20M

The heat transfer mechanisms taking place in the flow induced behind an incident shock wave traveling across a flat plate were investigated. The boundary layer behind the shock is described by a transient boundary layer followed by a steady state boundary layer as the effects of the leading edge are transmitted down stream. The transition from laminar to turbulent can take place in either boundary layer. Limited data exists on the transition region. The use of a multichannel high speed transient data recorder allowed thin film heat transfer gauges six axial locations down the length of a sharp edged flat plate to be simultaneously sampled. From this the heat transfer rate history for each location was time correlated to the same flow conditions. The results indicate that the transition from laminar to turbulent flow is occurring from the unsteady region of the flow. The initiation of transition to turbulent flow occurs at successive gauge locations at the same time relative to the incident shock passing the gauge position. Limited evidence is presented which indicates that the leading edge may retard the initiation of transition at gauge locations close to the leading edge if the steady Reynolds number for the flow behind the incident shock is in the laminar regime. GRA

N87-27973*# Purdue Univ., West Lafayette, Ind. School of Mechanical Engineering.
TURBULENCE CHARACTERISTICS OF AN AXISYMMETRIC REACTING FLOW Final Report
Richard D. Gould, Warren H. Stevenson, and H. Doyle Thompson
15 Sep. 1987 219 p
(Grant NAG3-502)
(NASA-CR-180697; NAS 1.26:180697) Avail: NTIS HC A10/MF A01 CSCL 20D

Simultaneous two-component laser velocimeter measurements were made in the turbulent flow field following an axisymmetric sudden expansion with and without combustion. The fuel (propane) and air were fully premixed to give a constant fuel-air ratio of 0.032 at the inlet for the combusting flow measurements. Reynolds number based on step height was 55,700. The primary objective was to obtain detailed measurements which would be of use to modelers. Quantities measured included mean axial and radial velocities, Reynolds stresses, and turbulent triple products. In addition, simultaneous time resolved temperature measurements were made in the reacting flow using high speed thermocouples. This permitted the computation of velocity-temperature correlations. Experimental results were compared to predictions from a widely used numerical code based on the kappa-epsilon turbulence model and the combustion model of Magnussen and Hjertager. Relatively good agreement was found for the cold flow case as in previous studies, but predicted values of temperature in the reacting flow case deviated substantially from the measurements. Sizable errors in the predictions for the velocity field also were found. Possible sources for the observed differences and suggestions for future model development are suggested. Author

N87-27974*# National Aeronautics and Space Administration, Washington, D.C.
HEAT TRANSFER DURING THE BOILING OF LIQUIDS IN HEAT PIPE WICKS
Yu. K. Gontarev, Yu. V. Navruzov, V. F. Prisnyakov, and N. Serebryanskiy Aug. 1987 10 p Transl. into ENGLISH from Promyshlennaya Teploteknika (USSR), v. 8, no. 4, 1986 p 11-14
Original language document was announced in IAA as A87-18823
Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-4004)

(NASA-TT-20108; NAS 1.77:20108) Avail: NTIS HC A02/MF A01 CSCL 20D

Data in the literature on heat transfer in the case of nucleate boiling of various liquids in the wicks of heat pipes are reviewed. It is shown that none of the known analytical relationships can be used to generalize, with sufficient accuracy, the experimental data found in the literature. It is further shown that the exponent of the specific heat flux in the heat transfer law changes as a function of the liquid and wick properties. A relationship is obtained which generalizes experimental data for heat transfer agents of moderate temperatures (water, acetone, ethanol, and R-11 and R-113 coolants) and ammonia. IAA

N87-27975# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

CONSERVATION LAW AND SHOCK WAVES: CLASS NOTES [LEIS DE CONSERVACAO E ONDAS DE CHOQUE: NOTAS DE AULA]

Marco Antonio Raupp and Antonio Candido Faleiros Oct. 1986 176 p In PORTUGUESE; ENGLISH summary

(INPE-4001-MD/032) Avail: NTIS HC A09/MF A01

The fundamental results of the mathematical theory of shock waves that was developed in the last decades are presented. It is composed of two parts. In the first, the results for a scalar conservation law are presented, giving special attention to Burger's equation, which has an accurate solution and is convenient to illustrate the theoretical results. In the second part, the systems of conservation laws are studied. Emphasis was given to the fundamental results obtained by Lax and Glimm with regard to the global solutions of the respective differential equations. Author

N87-27976*# Houston Univ., Tex. Dept. of Mechanical Engineering.

FINITE ELEMENT TECHNIQUES FOR THE NAVIER-STOKES EQUATIONS IN THE PRIMITIVE VARIABLE FORMULATION AND THE VORTICITY STREAM-FUNCTION FORMULATION Interim Report

F. Glaisner and T. E. Tezduyar Jul. 1987 65 p

(Contract NAS9-17380)

(NASA-CR-172005; NAS 1.26:172005) Avail: NTIS HC A04/MF A01 CSCL 20D

Finite element procedures for the Navier-Stokes equations in the primitive variable formulation and the vorticity stream-function formulation have been implemented. For both formulations, streamline-upwind/Petrov-Galerkin techniques are used for the discretization of the transport equations. The main problem associated with the vorticity stream-function formulation is the lack of boundary conditions for vorticity at solid surfaces. Here an implicit treatment of the vorticity at no-slip boundaries is incorporated in a predictor-multicorrector time integration scheme. For the primitive variable formulation, mixed finite-element approximations are used. A nine-node element and a four-node + bubble element have been implemented. The latter is shown to exhibit a checkerboard pressure mode and a numerical treatment for this spurious pressure mode is proposed. The two methods are compared from the points of view of simulating internal and external flows and the possibilities of extensions to three dimensions. Author

N87-27977*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CONTROLLED EXCITATION OF A COLD TURBULENT SWIRLING FREE JET

R. Taghavi, E. J. Rice, and S. Farokhi (Kansas Univ., Lawrence.) [1987] 13 p Prepared for presentation at the Winter Annual Meeting of the American Society of Mechanical Engineers, Boston, Mass., 13-18 Dec. 1987

(NASA-TM-100173; E-3741; NAS 1.15:100173) Avail: NTIS HC A02/MF A01 CSCL 20D

Experimental results from acoustic excitation of a cold free turbulent jet with and without swirl are presented. A flow with a swirl number of 0.35 (i.e., moderate swirl) is excited internally by plane acoustic waves at a constant sound pressure level and at various frequencies. It is observed that the cold swirling jet is excitable by plane waves, and that the instability waves grow about 50 percent less in peak rms amplitude, and saturate further upstream compared to corresponding waves in a jet without swirl having the same axial mass flux. The preferred Strouhal number based on the mass-averaged axial velocity and nozzle exit diameter for both swirling and nonswirling flows is 0.4. So far no change in the mean velocity components of the swirling jet is observed as a result of excitation. Author

N87-28085# Joint Publications Research Service, Arlington, Va.

RESONANCE PHENOMENA IN FLUID MEDIA Abstract Only

A. T. Lukyanov, V. M. Inyushin, and A. P. Gorokhov *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 31-32 Transl. into ENGLISH from Vestnik Akademii Nauk Kazakeskoy SSR (Alma-Ata, USSR), no. 7, Jul. 1986 p 14-15 (For primary document see N87-28073 22-42)

Avail: NTIS HC A05/MF A01

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources and Remote Sensing.* For related information see also *06 Aircraft Instrumentation,* and *19 Spacecraft Instrumentation.*

N87-27978# Quantel, Orsay (France).

CONJUGATE MIRROR GYROMETER Final Report [GYROMETRE A MIROIR CONJUGATE]

P. Aubourg and J. J. Roland 24 Oct. 1986 16 p In FRENCH

(Contract DRET-84/504)

(Rept-86-T-277; ETN-87-90130) Avail: NTIS HC A02/MF A01

The properties of ring cavities are studied using nonlinear photorefractive crystals. The crystals examined are BaTiO3 and bismuth silicon oxide. The feasibility of conjugate phase optical gyrometers is investigated. The sensitivity of several configurations is examined. A theoretical analysis is also presented. The results are negative. A theoretical interpretation is presented. ESA

N87-27979# Netherlands Energy Research Foundation, Petten.

USER'S GUIDE FOR THE TRIPLE-AXIS SPECTROMETER HB3

W. A. H. M. Vlak and E. Frikkee Nov. 1986 66 p

(ECN-189; B8681664; ETN-87-90175) Avail: NTIS HC A04/MF A01

Control of spectrometer operation and the data handling by means of a PDP 11/23 computer is explained. The various options are implemented in a collection of menu-driven and command-driven programs which utilize the flexibility of the RSX-11M operating system without requiring detailed knowledge of the user about this system. ESA

N87-27980# Sandia National Labs., Albuquerque, N. Mex.

RECENT DEVELOPMENTS IN PIEZOELECTRIC POLYMER STRESS GAUGES

R. P. Reed 15 May 1987 17 p Presented at the 14th Transducer Workshop, Colorado Springs, Colo., 16 Jun. 1987

(Contract DE-AC04-76DP-00789)

(DE87-010037; SAND-87-0154C; CONF-870692-2) Avail: NTIS HC A02

Piezoelectric polymer stress gauges of polyvinylidene fluoride (PVF2) now allow the accurate measurement of shock and stress waves of more than 200 GPa amplitude and time resolution generally of tens of ns but in special circumstances of a few ns. Among the many benefits of this gauge type are fidelity, high sensitivity, small size, simple signal conditioning, design versatility, flexibility, and adaptability to use in the radiation environment. Reliability and accuracy of PVF2 measurement transducers has been made possible only by the availability of well controlled material and development of special procedures for electrically

poling the material. This paper describes the measurement principle and application of the piezoelectric polymer material as well as some benefits and limitations of this class of stress gauge that is under development at Sandia National Laboratories. DOE

N87-27981# Oak Ridge National Lab., Tenn.
AN INTELLIGENT THICK-FILM GAS SENSOR: DEVELOPMENT AND PRELIMINARY TESTS
R. J. Lauf, B. S. Hoffheins, and C. A. Walls May 1987 43 p
(Contract DE-AC05-84OR-21400)
(DE87-011949; ORNL/TM-10402) Avail: NTIS HC A03/MF A01

Thick-film techniques were used to create a gas sensor that has a semiconducting oxide surface whose catalytic activity varies from point to point. An integral heater causes the oxide film to react with combustible gases; the electrical resistance of the oxide film is mapped through an array of electrodes to yield a signature that depends on how a particular gas reacts to each of the different areas on the sensor. The catalytic activity can be varied by establishing a thermal gradient across the sensor, by distributing different catalysts in different areas, or by a combination of both effects. For simple cases, the signature can be related to the functional groups present in the gas. As an example, using a uniform distribution of platinum and a thermal gradient, alcohols, ketones, and alkanes have distinctly different signatures. DOE

N87-27982 Technische Hogeschool Twente, Enschede (Netherlands).
DOMAINS IN CoCr LAYERS FOR PERPENDICULAR MAGNETIC RECORDING Ph.D. Thesis
Klaas Hemmes 1986 131 p
(ISBN-90-9001446-2; B8679681; ETN-87-90247) Copyright Avail: Issuing Activity

The magnetic properties of RF and magnetron sputtered CoCr (81/19 at %) films for perpendicular recording are studied. Experimental results indicate that the formation of reversed domains in CoCr films with a thickness larger than the critical film thickness is possible. The spike domains can be smaller than the column diameter of CoCr films. In this model the reversal mechanism, i.e., the growth of reversed spike domains at the expense of the main ones, could take place inside a column. Hence, it is a particle reversal process as well as a domain wall displacement. Therefore, if spike domains do exist in a CoCr film the film could behave magnetically as a particulate and as a continuous medium. ESA

N87-27983*# Bonneville Scientific, Salt Lake City, Utah.
SIX COMPONENT ROBOTIC FORCE-TORQUE SENSOR Final Report
Allen R. Grahn, Brad L. Hutchings, David R. Johnston, David C. Parsons, and Roland F. Wyatt Aug. 1987 136 p
(Contract NAS1-17997)
(NASA-CR-178347; NAS 1.26:178347) Avail: NTIS HC A07/MF A01 CSCL 14B

The results of a two-phase contract studying the feasibility of a miniaturized six component force-torque sensor and development of a working laboratory system were described. The principle of operation is based upon using ultrasonic pulse-echo ranging to determine the position of ultrasonic reflectors attached to a metal or ceramic cover plate. Because of the small size of the sensor, this technology may have application in robotics, to sense forces and torques at the finger tip of a robotic end effector. Descriptions are included of laboratory experiments evaluating materials and techniques for sensor fabrication and of the development of support electronics for data acquisition, computer interface, and operator display. Author

N87-27984# Spectron Development Labs., Inc., Costa Mesa, Calif.
OPTICAL TECHNIQUE FOR THE MEASUREMENT OF HIGH TEMPERATURE MATERIAL EROSION Annual Report, 1 Apr. 1986 - 31 Mar. 1987
K. A. Arunkumar and J. D. Trolinger Mar. 1987 33 p
(Contract F49620-85-C-0046)
(AD-A182182; Rept-87-2439-07; AFOSR-87-0840TR) Avail: NTIS HC A03/MF A01 CSCL 14A

Holographic interferometry was attempted as a means of monitoring surface erosion and rejected because of large signal-to-noise problems. A new type of common path diffuse point interferometer has been developed to profile (electrode) surfaces. Initial studies show that the stability of this interferometer is at least two orders of magnitude better than what has been seen with standard Michelson's interferometer. Some measurements carried out with this interferometer are reported here. GRA

N87-27985# Northwestern Univ., Evanston, Ill.
A PULSED FIELD GRADIENT NUCLEAR MAGNETIC RESONANCE SPECTROMETER FOR DIRECT MEASUREMENT OF IONIC DIFFUSION IN SOLID ELECTROLYTES Final Report, 1 Jan. 1985 - 31 Dec. 1986
Donald H. Whitmore 24 Apr. 1987 4 p
(Grant AF-AFOSR-0098-85)
(AD-A182211; AFOSR-87-0847TR) Avail: NTIS HC A02/MF A01 CSCL 07D

A pulsed field gradient nuclear magnetic resonance spectrometer was successfully constructed which is based on a superconducting magnet and has magic angle spinning capabilities. A dewar facility is an integral part of this system so as to permit investigation of ionic diffusion down to 77 K, along with a sample heating arrangement for diffusion measurements up to 300 C. This spectrometer has been employed in the measurements of protonic diffusion coefficients in beta-alumina solid electrolytes and cation, anion and self diffusion coefficients and amorphous polymeric electrolytes. GRA

N87-27986# Ballistic Research Labs., Aberdeen Proving Ground, Md.
PROJECTILE FOLLOWER SYSTEM
T. R. Bechtol Dec. 1986 26 p
(AD-A182362; BRL-TR-2771) Avail: NTIS HC A03/MF A01 CSCL 14B

An analysis is made of the photographic problems related to obtaining both high resolution and high framing motion pictures of high velocity tank gun projectiles in flight. Current and postulated solutions are examined in light of current and projected ammunition performance. Basic performance requirements for a projectile follower system are presented. GRA

N87-27987# Rensselaer Polytechnic Inst., Troy, N.Y.
NEW DIRECTIONS IN THE DIGITAL SIGNAL PROCESSING OF IMAGE DATA Final Report, Sep. 1982 - Oct. 1986
W. A. Pearlman, P. Burt, H. Freeman, M. W. Modestino, and H. Stark May 1987 76 p
(Contract F30602-82-K-0151)
(AD-A182609; RADC-TR-87-51) Avail: NTIS HC A05/MF A01 CSCL 08B

A wide range of tasks in image processing have been treated under this contract. The categories of image processing covered are target detection, pattern recognition, image recovery from incomplete information, restoration of blurred images in additive and multiplicative noise, motion analysis with fast hierarchical algorithms, image texture modeling and discrimination, image segmentation and removal of cloud cover from aerial photographs. In all of these tasks, new, efficient, and fast algorithms have been developed, which comprise a significant contribution to the field of image processing. Within the report are descriptions of the tasks and the resulting processing algorithms and citations of publications produced under this contract. Author (GRA)

N87-27988# SRI International Corp., Menlo Park, Calif.
FLOW-FIELD INSTRUMENTATION DEVELOPMENT Technical Report, 26 Sep. 1984 - 30 Sep. 1986
Alan A. Burns 30 Aug. 1986 140 p
(Contracts DNA001-84-C-0439; DNA Proj. Q93-QMXA)
(AD-A182620; DNA-TR-86-309) Avail: NTIS HC A07/MF A01 CSCL 20D

Equipment was assembled to make two new types of measurements of quantities important for describing shock wave effects in a dusty environment. The first of these employs a novel technique combining millimeter wave (mmW) RF phase shift and X-ray absorption measurements to obtain fluctuations in air and dust densities in the shock wave. Use of either an X-ray or RF technique above leads only to a weighted sum of air and dust densities. The second new technique uses the reflection of microwave signals from the bottom side of the soil surface to measure surface recession because of shock wave passage. This technique exploits the phenomenon of total internal reflection at a material interface. This report describes the techniques, the equipment, calibration, test results, problems encountered, and corrective actions. Results from the installation of the mmW/X-ray equipment at MINOR SCALE are described in an Appendix; these are believed to be the first reported simultaneous measurements of air and dust density in a shock front. GRA

N87-27989*# Arizona Univ., Tucson. Optical Sciences Center.
THE ABSOLUTE RADIOMETRIC CALIBRATION OF THE ADVANCED VERY HIGH RESOLUTION RADIOMETER Semiannual Status Report
P. N. Slater, P. M. Teillet, and Y. Mao Sep. 1987 27 p
(Grant NAG5-859)
(NASA-CR-181236; NAS 1.26:181236) Avail: NTIS HC A03/MF A01 CSCL 14B

The early results of an absolute radiometric calibration of the NOAA-9 AVHRR sensor indicate significant degradations in the response of bands 1 and 2 compared to prelaunch values. The results are currently in the process of being verified and it may be that refinements of the methodology will be in order as additional data sets are analyzed. The LANDSAT TM calibration used in this approach is known to be very precise and the Herman radiative transfer code, supplemented by the 5-S code for gaseous transmission, is reliable as well. The extent to which other steps in the analysis procedure give rise to uncertainties in the results is currently under investigation. Particular attention is being given to the geometric matching of the AVHRR and TM imagery, as well as to the spectral redistribution procedure. By taking advantage of a reasonably precise calibration of TM imagery acquired on the same day as the AVHRR data at White Sands, a promising approach to the in-orbit calibration of AVHRR sensors is being developed. Current efforts involve primarily the examination of additional test cases and the investigation of possible simplifications in the procedure through judicious use of atmospheric models. Author

N87-27990*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE ac AND dc ELECTRIC FIELD METERS DEVELOPED FOR THE US DEPARTMENT OF ENERGY
H. Kirkham, A. Johnston, S. Jackson, and K. Sheu Feb. 1987 137 p
(Contracts NAS7-918; DE-AI01-79ET-29372)
(NASA-CR-181323; JPL-Publ-87-20; DOE/ET29372-7; NAS 1.26:181323) Avail: NTIS HC A07/MF A01 CSCL 14E

Two space-potential electric field meters developed at the Jet Propulsion Laboratory under the auspices of the U.S. Department of Energy are described. One of the meters was designed to measure dc fields, the other ac fields. Both meters use fiber optics to couple a small measuring probe to a remote readout device, so as to minimize field perturbation due to the presence of the probe. By using coherent detection, it has been possible to produce instruments whose operating range extends from about 10 V/m up to about 2.5 kV/cm, without the need for range switching on the probe. The electrical and mechanical design of both meters are described in detail. Data from laboratory tests are presented, as well as the results of the tests at the National Bureau of Standards and the Electric Power Research Institute's High Voltage Transmission Research Facility. Author

N87-27991*# Information and Control Systems, Inc., Hampton, Va.
COMBINED OPTIMIZATION OF IMAGE-GATHERING AND IMAGE-PROCESSING SYSTEMS FOR SCENE FEATURE DETECTION Final Report
Nesim Halyo, Robert F. Arduini, and Richard W. Samms Aug. 1987 89 p
(Contract NAS1-17133)
(NASA-CR-178353; NAS 1.26:178353; FR-687101) Avail: NTIS HC A05/MF A01 CSCL 14B

The relationship between the image gathering and image processing systems for minimum mean squared error estimation of scene characteristics is investigated. A stochastic optimization problem is formulated where the objective is to determine a spatial characteristic of the scene rather than a feature of the already blurred, sampled and noisy image data. An analytical solution for the optimal characteristic image processor is developed. The Wiener filter for the sampled image case is obtained as a special case, where the desired characteristic is scene restoration. Optimal edge detection is investigated using the Laplacian operator x G as the desired characteristic, where G is a two dimensional Gaussian distribution function. It is shown that the optimal edge detector compensates for the blurring introduced by the image gathering optics, and notably, that it is not circularly symmetric. The lack of circular symmetry is largely due to the geometric effects of the sampling lattice used in image acquisition. The optimal image gathering optical transfer function is also investigated and the results of a sensitivity analysis are shown. Author

N87-27828# Joint Publications Research Service, Arlington, Va.
OPTIMUM SOLUTIONS AND QUASI-SOLUTIONS TO PROBLEMS OF MICROWAVE HOLOGRAPHY Abstract Only
Ye. N. Voronin *In its* USSR Report: Electronics and Electrical Engineering 6 Aug. 1987 p 52 Transl. into ENGLISH from Radiotekhnika i Elektronika (Moscow, USSR), v. 31, no. 8, Aug. 1986 p 1495-1506 (For primary document see N87-27821 22-31)
Avail: NTIS HC A05/MF A01

N87-28118# Politecnico di Milano (Italy).
LARGE FORMAT CAMERA: THE SECOND GENERATION PHOTOGRAMMETRIC CAMERA FOR SPACE CARTOGRAPHY
G. Togliatti and A. Moriondo *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 15-18 (For primary document see N87-28115 22-43)
Copyright Avail: NTIS HC A14/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.
For related information see also *76 Solid-State Physics.*

N87-27992# Sandia National Labs., Albuquerque, N. Mex.
EVALUATION AND MAPPING OF HEATSHIELD FLIGHT TEMPERATURE AND COMPOSITION WITH LASER RAMAN SPECTROSCOPIC TECHNIQUES
I. Auerbach, D. R. Tallant, and K. L. Higgins 1987 27 p Presented at the 22nd AIAA Thermophysics Conference, Honolulu, Hawaii, 8 Jun. 1987 Previously announced as A87-43131
(Contract DE-AC04-76DP-00789)
(DE87-010039; SAND-86-2762C; CONF-870623-5) Avail: NTIS HC A03/MF A01

A laser Raman spectroscopic technique has been developed which can measure the peak temperatures experienced by charring heatshield materials and determine their post test compositions (char, pyrolysis material and virgin resin). The technique has the capabilities of: (1) analyzing areas less than 0.004 in. in diameter, or lines 0.004 in. in width and 0.075 in. in length, thereby providing fine detail for surface and internal mappings, and (2) performing the analyses rapidly and conveniently in the laboratory following testing or flight recovery. Representative plots of temperature and composition profiles are provided. DOE

N87-27993# Technische Hogeschool, Delft (Netherlands). Dept. of Geodesy.
COLLAS: AN ALTERNATIVE APPROACH FOR THE ANALYSIS OF SATELLITE LASER RANGING (SLR) DATA COLLECTED DURING COLLOCATION TESTS Thesis
B. M. H. Blumer Aug. 1986 76 p
(B8681153; ETN-87-90170) Avail: NTIS HC A05/MF A01

Data taken by laser ranging systems during collocation tests were analyzed using polynomial or orbit analysis techniques (POLYQUICK and GEODYN). An approach using the geometry of quadrangles formed by the laser systems and the satellite predictions (COLLAS) was compared with GEODYN. Simulation tests on COLLAS show satisfactory results even with noise on the data and gaps in the dataset. Precision demands of the input, i.e., azimuth, elevation, basis vector, etc., can be met. For a single pass solution GEODYN requires 70 sec; COLLAS needs only 8 sec. The long arc and short arc analyses of GEODYN involve several iterations, COLLAS consists of only one analysis. ESA

N87-27994*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FREQUENCY DOMAIN LASER VELOCIMETER SIGNAL PROCESSOR: A NEW SIGNAL PROCESSING SCHEME
James F. Meyers and James I. Clemmons, Jr. Sep. 1987 38 p
(NASA-TP-2735; L-16209; NAS 1.60:2735) Avail: NTIS HC A03/MF A01 CSCL 20E

A new scheme for processing signals from laser velocimeter systems is described. The technique utilizes the capabilities of advanced digital electronics to yield a smart instrument that is able to configure itself, based on the characteristics of the input signals, for optimum measurement accuracy. The signal processor is composed of a high-speed 2-bit transient recorder for signal capture and a combination of adaptive digital filters with energy and/or zero crossing detection signal processing. The system is designed to accept signals with frequencies up to 100 MHz with standard deviations up to 20 percent of the average signal frequency. Results from comparative simulation studies indicate measurement accuracies 2.5 times better than with a high-speed burst counter, from signals with as few as 150 photons per burst. Author

N87-27995# Los Alamos National Lab., N. Mex.
SUPERLATTICE GEOMETRY FOR GAMMA-RAY LASERS
G. C. Baldwin 1987 21 p Presented at the General Meeting of the American Physical Society, Crystal City, Va., 20 Apr. 1987
(Contract W-7405-eng-36)
(DE87-010103; LA-UR-87-1517; CONF-870412-1) Avail: NTIS HC A02/MF A01

The central problem to developing a graser - that pumping can inhibit or destroy the Moessbauer and Borrmann effects - can conceivably be mitigated by a superlattice geometry, into which collimated coherent transfer radiation is introduced to form a multiwave Borrmann (or antiBorrmann) mode. This could also overcome the limitations of cooperation length and Fresnel number that otherwise restrict the size and performance of a superradiant graser. DOE

N87-27996# Lawrence Livermore National Lab., Calif.
X-RAY LASER WORLD WIDE PROGRESS
D. L. Matthews 12 May 1987 22 p Presented at the International School of Quantum Electronics, Erice, Italy, 11 May 1987
(Contract W-7405-eng-48)
(DE87-010337; UCRL-96579; CONF-8705118-1) Avail: NTIS HC A02/MF A01

This summary describes the X-ray laser, discusses its status of development world wide, and speculates on its future. At this time, vigorous research in the USA, France and Great Britain has not only demonstrated amplification of soft X-rays, but has pushed the observed lasing wavelengths from approx. 28 nm to 6.1 nm. Knowledge obtained from this work has led to the design of new schemes likely to reach even shorter wavelengths, perhaps less than the carbon K absorption edge at 4.37 nm. Researchers have also obtained saturated output at a few megawatts of power with a divergence (geometric) of a few mrad at approx. 20 nm. If research continues at this pace, the X-ray laser will be available in a few more years with GW power levels, sub 4.4 nm wavelengths and fully-coherent beams. DOE

N87-27997# Oak Ridge National Lab., Tenn.
THIRD-HARMONIC GENERATION IN BOTH POSITIVELY AND NEGATIVELY DISPERSIVE Xe
P. R. Blazewicz and J. C. Miller 1987 3 p Presented at the 8th International Conference on Laser Spectroscopy, Are, Sweden, 22 Jun. 1987
(Contract DE-AC05-84OR-21400)
(DE87-010913; CONF-8706128-1) Avail: NTIS HC A02/MF A01

In the present work, we have investigated modifications of third-harmonic (TH) generation by a second, strong laser. We report the observation of tunable TH light in the positively dispersive region on the low energy side of the Xe 6s prime (1/2) sup 0 sub 1 state induced upon introduction of a second, strong laser field. We also report observations of strong, systematic increases and decreases in ionization signals generated to the blue of the 6s prime level. Results are interpreted in terms of phase-matching changes induced by the second laser which affect TH production and subsequent ionization of Xe atoms. In addition, we present theoretical expressions developed by Payne and Garrett for the effect of the second laser field on TH production and MPI (multiphoton ionization) on both the positively and negatively dispersive sides of the three-photon resonances. DOE

N87-27998*# Schwartz Electro-Optics, Inc., Concord, Mass.
TITANIUM-DOPED SAPPHIRE LASER RESEARCH AND DESIGN STUDY Final Contractor Report
Peter F. Moulton Washington NASA Sep. 1987 59 p
(Contract NAS1-17961)
(NASA-CR-4093; NAS 1.26:4093) Avail: NTIS HC A04/MF A01 CSCL 20E

Three main topics were considered in this study: the fundamental laser parameters of titanium-doped sapphire, characterization of commercially grown material, and design of a tunable, narrow-linewidth laser. Fundamental parameters investigated included the gain cross section, upper-state lifetime as a function of temperature and the surface-damage threshold. Commercial material was found to vary widely in the level of absorption of the laser wavelength with the highest absorption in Czochralski-grown crystals. Several Ti:sapphire lasers were constructed, including a multimode laser with greater than 50mJ of output energy and a single-transverse-mode ring laser, whose spectral and temporal characteristics were completely characterized. A design for a narrow-linewidth (single-frequency) Ti:sapphire laser was developed, based on the results of the experimental work. The design involves the use of a single-frequency, quasi-cw master oscillator, employed as an injection source for a pulsed ring laser. Author

N87-27999 Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
CHAOS AND INSTABILITIES IN MULTIMODE CW DYE LASERS: OBSERVATIONS AND EXPLANATIONS
H. Atmanspacher and H. Scheingraber Jan. 1987 28 p Presented at the International Conference on Chaos and Systems Far From Equilibrium, Monterey, Calif., 11-14 Jan. 1987
(MPE-Preprint-83; ETN-87-90317) Copyright Avail: Fachinformationszentrum, Karlsruhe, West Germany

Deterministic chaos is found to be significant for the dynamics of CW multimode dye lasers. The crucial quantities characterizing deterministic chaos are the attractor dimension D and the Kolmogorov entropy K. Their experimental determination provides information about instabilities, mode coupling effects, and temporal correlation properties of the system. Quantities D and K were used to find concrete microphysical mechanisms (stimulated Brillouin scattering and spatial mode competition in the gain medium) which govern the behavior of the investigated laser system. ESA

N87-28000 Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
A CLASSIFICATION OF FAST QUASI-PERIODIC X-RAY OSCILLATORS: IS 6 Hz A FUNDAMENTAL FREQUENCY?
G. Hasinger Mar. 1987 25 p Submitted for publication
(MPE-Preprint-85; ETN-87-90318) Copyright Avail: Fachinformationszentrum, Karlsruhe, West Germany

It is demonstrated that nearly all observed X-ray binary quasi-periodic oscillations (QPO) can be grouped into 2 major classes: intensity-dependent QPOs with frequencies of 20 to 55 Hz associated with strong red noise on the horizontal spectral branch; and the majority of QPOs, found during normal branch behavior with very weak red noise and constant frequencies clustering around 6 Hz. The fact that the QPO frequency in this mode is stable and almost the same between different systems suggests a mechanism that can be described by fundamental physical properties of the neutron star and its close environment. It is suggested that on the normal branch the X-ray flux is modulated by a nonradial resonant sound wave in the Eddington-limited accretion flow above the neutron star surface. This model explains the low value and the constancy of the QPO frequency and the absence of red noise in the normal branch. If this interpretation is correct, neutron star radii and distances can be estimated from QPO observations. ESA

N87-28001# Naval Research Lab., Washington, D.C.
THE FREE ELECTRON LASER SIDEBAND INSTABILITY RECONSIDERED
S. Riyopoulos and C. M. Tang 1986 21 p
(AD-A182153) Avail: NTIS HC A02/MF A01 CSCL 09C

The one-dimensional fast time averaged Hamiltonian is derived in a free electron laser (FEL) for electrons passing through a constant wiggler and a radiation field. The exact unperturbed orbits without sidebands are obtained for all particles and arbitrary separatrix width delta sub gamma. Integration in action-angle variables of the linearized Vlasov equation with perturbing sidebands over the unperturbed orbits yields the sideband gain for both trapped and untrapped particles. The unperturbed distribution f sub 0 is in an adiabatic equilibrium with the main signal field. It is found that upper and lower sidebands that are symmetric relative to the FEL frequency have opposite growth rates. There is no differentiation in the magnitude of the gain between upper and lower sidebands. The stability is determined by the sign of df sub 0/d omega sub b, i.e., the relative population of oscillation quanta h-bar omega sub b, omega sub b = bounce frequency around resonance. The shear d omega sub b/dJ, where J is the action variable, is stabilizing and distributions with gradients df sub 0/dJ localized near the separatrix have the minimum growth rates. The structure and scaling of the unstable spectrum are different from previous results obtained for electrons localized at the bottom of the ponderomotive well. GRA

N87-28002# State Univ. of New York, Buffalo. Dept. of Chemistry.
THEORY OF LASER-STIMULATED PROCESSES. PART 3: DESORPTION THROUGH VIBRATIONAL EXCITATION BY AN IR LASER
A. C. Beri and Thomas F. George Jun. 1987 26 p
(Contracts N00014-86-K-0043; F49620-86-C-0009)
(AD-A182209-Pt-3; UBUFFALO/DC/87/TR-41-Pt-3) Avail: NTIS HC A03/MF A01 CSCL 07E

Desorption of an adatom from a solid surface through vibrational excitation by an IR laser is studied using a generalized master equation approach and the isomnesic approximation. A sharp transition from no desorption to almost instantaneous desorption is seen as the bound-to-continuum population transfer rate is varied. The critical rate increases linearly with laser power. GRA

N87-28003# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
MATERA LASER COLLOCATION EXPERIMENT
Edward M. Gaposchkin, Lorraine E. Kurtz, and Anthea J. Coster 27 May 1987 49 p
(Contract F19628-85-C-0002)
(AD-A182214; TR-780; ESD-TR-86-199) Avail: NTIS HC A03/MF A01 CSCL 17E

Three laser ranging stations were collocated at Matera, Italy, in January, February, and March 1986. They observed 92 passes of the LAGEOS Satellite, of which 56 passes were observed by more than one system. This set of data allows intercomparison of the three laser ranging systems, and assessment of the Quick Look data from each system. In addition, this data set allows examination of tropospheric refraction models using dispersion since two distinct optical wavelengths were used. It has been found that the three laser ranging systems agree to within 1.7 cm in range. It has also been found that the nominal refraction model has no significant errors greater than 0.12 cm in Zenith refraction and 0.64 cm in the mapping function down to 20 deg elevation. GRA

N87-28004# Florida Univ., Gainesville. Space Astronomy Lab.
THE INTERACTION OF SMALL PARTICLES WITH LASER BEAMS Annual Report, 9 Jul. 1985 - 9 Oct. 1986
Nebil Y. Misconi, Keith F. Ratcliff, E. T. Rusk, and J. P. Oliver 18 Feb. 1987 191 p Prepared in cooperation with State Univ. of New York at Albany
(Contract F49620-85-C-0117)
(AD-A182225; AFOSR-87-0664TR) Avail: NTIS HC A09/MF A01 CSCL 20F

Summarized is research under Award/Contract F49620-85-C-0117 which deals with the interaction of a CW Argon laser beam with a variety of layers of small (few microns to a few hundred microns) particles formed out of silicates which are highly transparent over the range of wavelengths 0.22 to 2.2 microns. Thicknesses of these layers range from 0.25 mm to 2mm. The nature of this research is to characterize the scattering of laser light by these layers. It was found that a layer of natural sand reflects more laser light than suprasil, flexolite glass, tinted commercial glass, or crown glass spheres; reflectivity varied inversely with particle size. Quantitative measurements were carried out and results on thickness of layers and size of particles are tabulated. Curves of intensity vs. scattering angle are displayed for each layer. GRA

N87-28005# Science Research Corp., Somerville, Mass.
NEW CONCEPT FOR SCALING EXCIMER LASER AMPLIFIERS Final Technical Report, 1 Oct. 1985 - 30 Apr. 1987
Reich Watterson 30 Jun. 1987 48 p
(Contract N00014-85-C-0740)
(AD-A182525; SRL-04-F-1987) Avail: NTIS HC A03/MF A01 CSCL 20E

A novel concept for efficient volumetric scaling of excimer lasers to high average power and energy was theoretically and experimentally investigated. Numerical calculations of the extraction efficiency of an excimer laser amplifier with a nonsaturable distributed loss are described. These results show that expanding the beam as it traverses the amplifier can lead to considerably improved extraction efficiency. Expansion angles of 2 to 5 degrees are useful for large scale laser amplifiers (10 meters in length). A small scale proof-of-principle experiment was constructed. This consisted of an electron beam pumped XeCl master oscillator-amplifier system. A 250 kV electron beam pumped an 11 cm x 11 cm x 100 cm active volume which served as both oscillator and amplifier. Measurements of the extraction efficiency were performed for collimated, cylindrically expanding, and spherically expanding beams. An expansion angle of approximately 0.6 degrees led to an improvement of as much as a factor of 2 in integrated extraction efficiency. GRA

N87-28006* National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD AND APPARATUS FOR ENHANCING LASER ABSORPTION SENSITIVITY Patent
Christopher R. Webster, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 4 Aug. 1987 15 p Filed 31 Jul. 1985 Supersedes N86-20777 (23 - 11, p 1780

(NASA-Case-NPO-16567-1-CU; US-Patent-4,684,258; US-Patent-Appl-SN-760790; US-Patent-Class-356-409; US-Patent-Class-250-339; US-Patent-Class-250-343; US-Patent-Class-250-373; US-Patent-Class-356-51; US-Patent-Class-356-256) Avail: US Patent and Trademark Office CSCL 20E

A simple optomechanical method and apparatus is described for substantially reducing the amplitude of unwanted multiple interference fringes which often limit the sensitivities of tunable laser absorption spectrometers. An exterior cavity is defined by partially transmissible surfaces such as a laser exit plate, a detector input, etc. That cavity is spoiled by placing an oscillating plate in the laser beam. For tunable diode laser spectroscopy in the mid-infrared region, a Brewster-plate spoiler allows the harmonic detection of absorptances of less than 10 to the -5 in a single laser scan. Improved operation is achieved without subtraction techniques, without complex laser frequency modulation, and without distortion of the molecular lineshape signal. The technique is applicable to tunable lasers operating from UV to IR wavelengths and in spectrometers which employ either short or long pathlengths, including the use of retroreflectors or multipass cells.

Official Gazette of the U.S. Patent and Trademark Office

N87-28380# Joint Publications Research Service, Arlington, Va.
RESEARCH IN PHYSICS OF NARROW-BAND SEMICONDUCTORS AND THEIR USE AS BASIS FOR TUNABLE INFRARED INJECTION LASERS Abstract Only
A. P. Shotov *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 5 Transl. into ENGLISH from Vestnik Akademii Nauk SSSR (Moscow, USSR), no. 6, Jun. 1986 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

N87-28382# Joint Publications Research Service, Arlington, Va.
FORMATION OF SHORT GIANT RADIATION PULSE IN YAG:Nd3+ LASER WITH UNSTABLE RESONATOR Abstract Only
Yu. L. Kokurin, N. Ye. Kuzmenko, V. M. Mizin, R. A. Petrenko, A. A. Statsenko, A. N. Sukhanovskiy, and N. Ya. Nedbayev *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 17 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 12, Dec. 1986 p 2541-2542 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

N87-28383# Joint Publications Research Service, Arlington, Va.
KINEMATIC MODE LOCKING IN CONTINUOUS-WAVE YAG:Nd3+ RING LASER Abstract Only
L. S. Kornishenko, T. V. Klykova, N. V. Kvartsov, V. A. Sidorov, A. M. Susov, and Yu. P. Yatsenko *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 18 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 12, Dec. 1986 p 2479-2485 Original language document was announced in IAA as A87-38292 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

N87-28384# Joint Publications Research Service, Arlington, Va.
PARAELECTRODE EFFECTS IN PERIODIC-PULSE EXCIMER LASER Abstract Only
R. V. Arutyunyan, V. M. Borisov, A. Yu. Vinokhodov, Yu. B. Kiryukhin, and A. N. Morozov *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 19 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 12, Dec. 1986 p 2403-2407 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

N87-28385# Joint Publications Research Service, Arlington, Va.
HIGH-POWER LASER SET WITH PLATE-SHAPED AMPLIFIER ON NEODYMIUM GLASS GENERATING PICOSECOND PULSES AT REPETITION RATES UP TO 1 Hz Abstract Only
A. Varanavichyus, R. Grigonis, R. Danelyus, A. Piskarskas, and D. Podenas *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 20 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 12, Dec. 1986 p 2391-2395 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

N87-28386# Joint Publications Research Service, Arlington, Va.
MOLECULAR PHOTODISSOCIATION LASER EMITTING BLUISH-GREEN LIGHT WITH ENERGY OF 3 J Abstract Only
S. L. Bazhulin, N. G. Basov, S. N. Burgimov, V. S. Zuyev, A. S. Kamrukov, N. P. Kozlov, A. G. Opekan, and Yu. S. Protasov *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 20 Transl. into ENGLISH from Pisma v Zhurnal Tekhnicheskoy Fiziki (Leningrad, USSR), v. 12, no. 23, 12 Dec. 1986 p 1423-1429 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

N87-28387# Joint Publications Research Service, Arlington, Va.
EFFECT OF COHERENT PROCESSES ON LIGHT PULSES IN Ar+-LASER WITH ACTIVE MODE LOCKING Abstract Only
A. A. Apolonskiy *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 21-22 Transl. into ENGLISH from Optika i Spectroskopiya (Leningrad, USSR), v. 61, no. 4, Oct. 1986 p 898-900 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

N87-28388# Joint Publications Research Service, Arlington, Va.
EMISSION OF PICOSECOND PULSES BY HETEROJUNCTION INJECTION LASERS WITH Q-SWITCHING Abstract Only
Zh. I. Alferov, A. B. Zhurvalev, Ye. L. Portnoy, and N. M. Stelmakh *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 27-28 Transl. into ENGLISH from Pisma v Zhurnal Tekhnicheskoy Fiziki (Leningrad, USSR), v. 12, no. 18, 26 Sep. 1986 p 1093-1098 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

37 MECHANICAL ENGINEERING

Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

N87-28007# Thermo Mechanical Systems Co., Canoga Park, Calif.
EXPLORATORY DEVELOPMENT OF A TWIN-SPOOL TURBOCHARGER FOR A HIGH OUTPUT DIESEL ENGINE Final Report, Sep. 1983 - Jun. 1986
Richard Hess, Joseph F. King, and James L. Harp, Jr. Aug. 1986 127 p
(Contract DAAE07-83-C-R129)
(AD-A181273; SR-41; TACOM-TR-13197) Avail: NTIS HC A07/MF A01 CSCL 21E

The analysis, design, fabrication and experimental testing of a twin spool turbocharger was conducted for the Cummins NTC-475 diesel engine. Two major designs of the twin-spool turbocharger were fabricated and tested: (1) Compact design, concentric shaft-to-shaft bearing coupled turbocharger incorporating (a) split 40 deg backswept impeller, (b) split AiResearch Ti8A85 turbine rotor, (c) adjustable vaned compressor diffuser, and (d) nozzleless AiResearch turbine (volute) housing; and (2) Independently supported (shafts dynamically de-coupled) concentric shaft design incorporating (a) separate structures for bearing support of the inner shaft (b) split 25 deg backswept compressor impeller, (c) split T18A40/Ti8A85 turbine rotor/exducer combination, and (d) divided volute, adjustable nozzle turbine housing. While bench tests were performed on both designs, engine testing was successfully carried out using the latter designs. Tests indicated that the second twin-spool configuration gave performance comparable to the originally equipped two-stage turbocharger system of the NTC-475 diesel engine (rated BHP of 425 hp at 2100 RPM, best BSFC of 0.35 at engine lug) with the added benefit of extending engine lugging range to 1200 RPM (from 1300 RPM, as originally equipped). This configuration gave peak compressor efficiency of

about 75% and peak turbine efficiency of about 80%, both attributed to the reduction inducer angle of attack and exducer exit swirl angle made possible by the twin-spool concept. GRA

N87-28008# First Omega Group, Inc., Golden, Colo.
COOLING SYSTEM DEGRADATION INDICATOR, PHASE 1 Final Report, Aug. 1986 - Jan. 1987
Charles E. Brossia and Samuel C. Wu 23 Jan. 1987 54 p
(Contract DAAE07-86-C-R072)
(AD-A181307; A86-117-1-F; TACOM-TR-13240) Avail: NTIS HC A04/MF A01 CSCL 21G

The Phase 1 Small Business Innovation Research completed demonstrates the feasibility of determining the cooling system performance of an engine by monitoring two temperature parameters associated with the engine system, ambient air temperature, (TA), and coolant temperature at the coolant exit point from the engine, (TB). The performance of the cooling system was computed through a proposed algorithm with real-time TA and TB as inputs. The inputs were fed into a custom-designed prototype electronic circuit that performed the computation when TB exceeded 205 F. The output of the circuit was a digital readout of the cooling system performance degradation in percent. The proposed algorithm was shown to be unsuitable for the intended purpose. However, the experimental results led to the discovery of a different algorithm which provided the indication of cooling system performance with TA and TB inputs. GRA

N87-28009# Sandia National Labs., Albuquerque, N. Mex.
AN EVALUATION OF CONSUMABLE INSERTS FOR GAS TUNGSTEN ARC WELDING
A. E. Chavez and S. J. Marburger Mar. 1987 71 p
(Contract DE-AC04-76DP-00789)
(DE87-007899; SAND-87-8206) Avail: NTIS HC A04/MF A01

This study presents information on the use of consumable inserts to make 100% penetration welds in 304 and modified A286 (designated JBK-75) stainless steels. Current and voltage ranges which produced acceptable welds were found for different combinations of joint preparations and inserts. Three third member insert designs were examined: Type A (AWS Class 1), Type G (AWS Class 3), and Type K (AWS Class 5). One joint design incorporated the configuration of the Type G insert into the root face of the joint (termed an integral insert). Joints welded with and without filler wire addition were made for comparison. Metallurgical and radiographic tests were done on all welds. It was found that the consumable insert root pass was comparable to the wire-fed root pass in weld shape and size using the same parameters; it also had additional advantages in ease of use, cleanliness, inspectability and reduced procedure complexity. DOE

N87-28010# Hanford Engineering Development Lab., Richland, Wash.
PULSED MAGNETIC WELDING
W. F. Sheely 20 Nov. 1986 6 p
(Contract DE-AC06-76FF-02170)
(DE87-010220; HEDL-SA-3638-VT) Avail: NTIS HC A02/MF A01

Solid state welding techniques are an alternative to fusion welding. Two solid state welding techniques are pulsed magnetic welding and explosive bonding. Both achieve bonds by impacting the metals to be joined at high velocity. Development of the pulsed magnetic welding process by Hanford Engineers for fuel fabrication may make this process useful for a variety of other applications. Hanford engineers have developed advanced equipment for pulsed magnetic welding and have defined conditions for reliably welding stainless steel fuel pins using this equipment. DOE

N87-28011*# Georgia Inst. of Tech., Atlanta. School of Mechanical Engineering.
HIGH SPEED PRECISION MOTION STRATEGIES FOR LIGHTWEIGHT STRUCTURES Semiannual Progress Report, 15 Nov. 1986 - 14 May 1987
Wayne J. Book 1987 8 p
(Grant NAG1-623)
(NASA-CR-181283; NAS 1.26:181283) Avail: NTIS HC A02/MF A01 CSCL 05H

Work during the recording period proceeded along the lines of the proposal, i.e., three aspects of high speed motion planning and control of flexible structures were explored: fine motion control, gross motion planning and control, and automation using light weight arms. In addition, modeling the large manipulator arm to be used in experiments and theory has lead to some contributions in that area. These aspects are reported below. Conference, workshop and journal submissions, and presentations related to this work were seven in number, and are listed. Copies of written papers and abstracts are included. Author

N87-28012# International Trade Administration, Washington, D.C.
COMPETITIVE ASSESSMENT OF THE US ROBOTICS INDUSTRY
Mar. 1987 96 p
(PB87-188363) Avail: NTIS HC A05/MF A01 CSCL 13I

Robots are becoming increasingly important to U.S. manufacturers as a means to increase productivity and manufacturing flexibility, and reduce product costs. New robot orders escalated rapidly in the period 1983 to 1985. Robot purchases were essentially flat in 1986, and industry observers predict as much as a 20 percent decline for 1987. Japan supplies 80 percent of the U.S. robot imports. Many U.S. firms marketing robots have found it cost effective to import basic robots, focusing their engineering and research and development efforts on the development of accessories and peripherals that enhance end use applications. Japan dominates the world robot market, with over half of total world production. Sales by U.S. producers lag far behind those by major Japanese producers, and European producers such as the Swedish firm ASEA, which alone accounts for 9 percent of world robot sales. Producers in Japan and Europe are concentrating on closing any technological gaps in areas where they lag U.S. producers. Where they are ahead in some areas, they are extending their lead over U.S. suppliers. GRA

N87-28013# Georgia Inst. of Tech., Atlanta. School of Mechanical Engineering.
BRACING APPROACH TO HIGH SPEED MANIPULATION WITH LIGHTWEIGHT ROBOT ARMS Final Report, 15 Sep. 1983 - 31 Aug. 1985
W. J. Book May 1986 94 p
(Grant NSF MEA-83-03539)
(PB87-195582; NSF/ENG-86049) Avail: NTIS HC A05/MF A01 CSCL 13I

The concept of bracing a robot arm to increase its rigidity during small, accurate motions of its end point is examined. The approach eliminates the conflict between fine motion speed, which is enhanced by rigidity, and large motion speed, which is enhanced by light weight. With bracing, the arm is temporarily attached at a bracing point to a stationary supporting structure or the work piece (if it is large) during the fine motion phase of the task. Motion is carried out by additional degrees of freedom such as an end effector. By enabling robot arms to work in this manner, lighter, faster, less expensive, and more accurate robot arms may be possible. GRA

N87-28014# Sandia National Labs., Albuquerque, N. Mex.
CHARACTERIZATION OF ACCELEROMETER MOUNTINGS IN SHOCK ENVIRONMENTS
V. I. Bateman and O. M. Solomon, Jr. 1987 21 p Presented at the 14th Transducer Workshop, Colorado Springs, Colo., 16 Jul. 1987
(Contract DE-AC04-76DP-00789)
(DE87-009295; SAND-86-1606C; CONF-870755-1) Avail: NTIS HC A02

This report describes the shock test characterization of four accelerometer mounting techniques which are: adiprene and wax, polysulfide rubber and wax, restrained adiprene, and hard mount. The mountings have all been used in field tests, and the shock

testing provides some simulation of the field test environments. The characteristics of these mountings are analyzed in the time-domain and in the frequency-domain and are compared to the response of a reference accelerometer at two different shock levels, approximately 2 kg and 7 kg. While soft mounting techniques can be used to guarantee accelerometer survival in severe mechanical environments, this report documents the tested mounting materials to be highly nonlinear. These nonlinearities result in significant data distortion at frequencies above a few hundred hertz. DOE

N87-28015# Lawrence Livermore National Lab., Calif.
A DESIGN PROCEDURE TO TUNE THE DYNAMIC STIFFNESS OF AN EXTERNALLY PRESSURIZED GAS BEARING
J. W. Roblee 14 Apr. 1987 13 p Presented at the 4th International Technical Symposium on Optical and Electro-optical Applied Science and Engineering, Hague, Netherlands, 30 Mar. 1987
(Contract W-7405-eng-48)
(DE87-009747; UCRL-96629; CONF-8703127-1) Avail: NTIS HC A02

A design procedure for flat, circular thrust bearings is presented here. The procedure is based on a new dynamic model of the bearing and the principle of tuning the bearing's dynamic stiffness to optimize the dynamic performance of the overall, machine-bearing system. The design procedure is iterative so as to satisfy a number of different design constraints and is illustrated in an example problem. DOE

N87-28016# Mound Lab., Miamisburg, Ohio.
JOINING ALUMINA CERAMICS WITH TITANIUM-CONTAINING BRAZE ALLOYS
Roger T. Cassidy, Russell E. Pence, William E. Modderman, Edward M. Spangler, and Joyce C. Cramer 29 Oct. 1986 28 p
(Contract DE-AC04-76OP-00053)
(MLM-3394) Avail: NTIS HC A03/MF A01

Under conventional methods, the joining of an alumina ceramic body to either another ceramic or to a metal is a complex process that is time consuming and, therefore, costly. In addition, ceramic deformation often occurs as a result of firing at high temperatures. A newly developed braze material that can be directly applied to a bare ceramic surface is now commercially available. This material eliminates the need to metallize and to plate the ceramic surface prior to joining, and also eliminates the need to seal at high temperatures. A small titanium addition (1to 3 wt%) enables the braze material to wet the ceramic surface directly. In this investigation, the tensile strength of two different compositions of active braze alloys (ABA) was determined. In addition, extensive optical, SEM, BS, EDS, WDS, and scanning Auger microscopy examination of brazed ceramic samples was made to determine reaction mechanisms and fracture modes at the ceramic-alloy braze interface. Author

N87-28017# Naval Postgraduate School, Monterey, Calif.
A COMPUTER SIMULATION STUDY OF TRIPOD FOLLOW-THE-LEADER GAIT COORDINATION FOR A HEXAPOD WALKING MACHINE M.S. Thesis
Relle L. Lyman, Jr. Jan. 1987 177 p
(AD-A181995; NPS52-87-023) Avail: NTIS HC A09/MF A01 CSCL 13I

A new type of gait and steering algorithm for use by a six-legged walking machine is developed and presented in this study. The spatially oriented tripod follow-the-leader gait is an extension of previous studies of temporal follow-the-leader gaits, and should prove useful for all-terrain walking vehicles, such as the Adaptive Suspension Vehicle. Tractor-trailer style steering is introduced as an effort to tailor steering control for this type of gait. Both gait and steering algorithms are implemented on a color graphics computer simulation for study and comparison with other walking algorithms. GRA

N87-28018# Carnegie-Mellon Univ., Pittsburgh, Pa. Robotics Inst.
AUTOMATIC ROBOT INITIALIZATION USING A PLANAR TARGET SCANNED BY AN OPTICAL REFLECTION SENSOR
R. Q. Yang and M. W. Siegel Apr. 1987 20 p
(AD-A182510; CMU-RI-TR-87-9) Avail: NTIS HC A02/MF A01 CSCL 13H

An automatic initialization scheme is described for finding a point of coincidence between a robot's internal coordinate system and the coordinate system of its work space. The method uses an optical transmitter-receiver pair mounted on the robot end effector to scan a T-shaped planar target mounted on the work surface. An automated iterative method for moving a point on the end effector into precise coincidence with the point of intersection between a sensed plane parallel to the work surface and a sensed line normal to the work surface is shown to converge rapidly. GRA

N87-28019# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ROBOTICS APPLICATIONS FOR THE TESTING OF INERTIAL SENSORS M.S. Thesis
Joy Y. Greig May 1987 100 p
(AD-A182591; AFIT/GE/ENG/87J-4) Avail: NTIS HC A05/MF A01 CSCL 14B

This thesis investigates the technical and economic feasibility of using robots as testbeds for inertial sensors in lieu of the current generation of unique, expensive, and relatively inflexible gyro and accelerometer test facilities. A PUMA 560 robot arm is used as the experimental testbed. The design and demonstration of three tests are described which illustrate the alignment, calibration, and resulting performance of the robot as a test device. Actual high precision inertial accelerometers and gyros were used to establish a performance baseline and to evaluate the robot's test capabilities. The robot was programmed to act as a precision test servomechanism which was calibrated and aligned automatically using the high quality sensors. The robot was effective in providing quick-look results of error coefficient parameters for bias, scale factor, and elastic (g-squared) effects, but as expected could not provide inherently the precision required for very high quality sensor testing. GRA

N87-28020 Central Electricity Generating Board, London (England). Translation Section, Overseas Service.
SERVICEABILITY OF WELD JOINTS IN 12Cr1MoV STEEL WITH AUSTENITIC WELD SEAMS
F. A. Khromchenko and N. E. Farashyan 3 Aug. 1987 18 p Transl. into ENGLISH from Sverochnoe Proizvodstvo (USSR), no. 4, 1983 p 18-21
(CE-Trans-8270; BLL-GEGB-9022.09) Avail: Issuing Activity

Tests were carried out to determine the serviceability of weld joints in 12Cr1MoV steel with 08Ni60Mn7MoTi, 11Cr15Ni25Mo6-AlMn2, 08Cr15Ni60Mo10Mn2, 07Cr19Ni11Mo3Mn2V and 08CR19-Ni10Mn2WNb type seams produced with TsT-36, EA-395/9, ANZhR-1, EA-400/10u and Ts-16 type electrodes respectively. According to the heat resistance, crack resistance, technological strength and low cycle endurance indices the maximum serviceability of weld joints is achieved when welding fillet welds with EA-395/9 electrodes on a layer of 08Ni60Mn7Mo7Ti type high nickel weld metal deposited on the weld grooves. A technique was developed and adopted, which enables connection to be welded to headers made from 12Cr1MoV type steel with the aid of austenitic electrodes without post-weld heat treatment. Author

N87-28021*# National Aeronautics and Space Administration, Washington, D.C.
MECHANICAL CHARACTERISTICS OF FILAMENT-WOUND PRESSURE VESSEL (BURST PRESSURE)
H. Iida and M. Uemura Jul. 1987 22 p Transl. into ENGLISH from Japan Society for Aeronautical and Space Sciences Journal (Japan), v. 33, no. 381, 1985 p 592-600 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-4005)
(NASA-TT-20089; NAS 1.77:20089; ISSN-0021-4663) Avail: NTIS HC A02/MF A01 CSCL 13I

The finite element method is used to analyze the mechanical characteristics of a pressurized filament-wound (FW) pressure vessel, and to predict its burst pressure. The analysis takes into account the bending moment, the stretch-bend coupling effect, nonlinear stress-strain relations, and finite deflection. The analysis is based on two initial failure criteria for laminae, and two ultimate fracture criteria for laminated structures. The numerical results, obtained by applying the load incremental method to the isotensoid CFRP pressure vessel used in the launching of the Zikiken satellite, are in good agreement with the experimental burst pressure and fracture behaviors. Author

N87-28022*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GAS ADSORPTION/ABSORPTION HEAT SWITCH, PHASE 1 Final Report
C. K. Chan 15 Jul. 1987 197 p
(Contract NAS7-918)
(NASA-CR-181327; JPL-Publ-87-7; NAS 1.26:181327) Avail: NTIS HC A09/MF A01 CSCL 13I

The service life and/or reliability of far-infrared sensors on surveillance satellites is presently limited by the cryocooler. The life and/or reliability, however, can be extended by using redundant cryocoolers. To reduce parasitic heat leak, each stage of the inactive redundant cryocooler must be thermally isolated from the optical system, while each stage of the active cryocooler must be thermally connected to the system. The thermal break or the thermal contact can be controlled by heat switches. Among different physical mechanisms for heat switching, mechanically activated heat switches tend to have low reliability and, furthermore, require a large contact force. Magnetoresistive heat switches are, except at very low temperatures, of very low efficiency. Heat switches operated by the heat pipe principle usually require a long response time. A sealed gas gap heat switch operated by an adsorption pump has no mechanical motion and should provide the reliability and long lifetime required in long-term space missions. Another potential application of a heat switch is the thermal isolation of the optical plane during decontamination. Author

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N87-28023# RAND Corp., Santa Monica, Calif.
USING THE AIR FORCE MAINTENANCE DATA COLLECTION SYSTEM DATA TO IDENTIFY CANDIDATES FOR IMPROVEMENT IN RELIABILITY AND MAINTAINABILITY Interim Report
R. L. Petruschell, G. K. Smith, and T. F. Kirkwood Mar. 1987 94 p
(Contract F49620-86-C-0008)
(AD-A181464; RAND/N-2549-AF) Avail: NTIS HC A05/MF A01 CSCL 01C

This Note describes a preliminary and limited set of measures using data from the Air Force Maintenance Data Collection System (MDC) to identify likely candidates for reliability and maintainability (R and M) improvement. The method's usefulness depends on the user's having better than average knowledge of the MDC and of base-level maintenance. The MDC is a large, complex, and rich data system. Its magnitude alone is forbidding. The two-step method described shows how to distill these data, prepare useful metrics, and present these data in useful ways to R and M decisionmakers. Site investigations and interviews should be conducted to check the reasons for any high maintenance activity and to understand variability among bases before any R and M improvement program is instituted on a particular system or component. GRA

N87-28024# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction Scientifique de la Resistance des Structures.
ULTRASOUND INSTALLATION: TRANSMISSION TESTS IN COMPOSITE CONTROL Final Report [INSTALLATION ULTRASONORE: DEPOUILLEMENT D'ESSAIS EN TRANSMISSION SUR COMPOSITES]
H. Kaczmarek and J. Renard Oct. 1986 40 p In FRENCH
(Contract STPA-85-95-004)
(ONERA-RT-12/3542-RY-050-R; ETN-87-90124) Avail: NTIS HC A03/MF A01

An ultrasonic facility was used to follow the evolution of composite defects under traction or compression loads. The main problems studied include transversal cracking and its influence on delamination. Results are the identification of improved test parameters to implement a manufacturing control procedure. ESA

N87-28025*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A TECHNIQUE FOR EVALUATING THE APPLICATION OF THE PIN-LEVEL STUCK-AT FAULT MODEL TO VLSI CIRCUITS
Daniel L. Palumbo and George B. Finelli Sep. 1987 45 p
(NASA-TP-2738; L-16269; NAS 1.60:2738) Avail: NTIS HC A03/MF A01 CSCL 14D

Accurate fault models are required to conduct the experiments defined in validation methodologies for highly reliable fault-tolerant computers (e.g., computers with a probability of failure of 10 to the -9 for a 10-hour mission). Described is a technique by which a researcher can evaluate the capability of the pin-level stuck-at fault model to simulate true error behavior symptoms in very large scale integrated (VLSI) digital circuits. The technique is based on a statistical comparison of the error behavior resulting from faults applied at the pin-level of and internal to a VLSI circuit. As an example of an application of the technique, the error behavior of a microprocessor simulation subjected to internal stuck-at faults is compared with the error behavior which results from pin-level stuck-at faults. The error behavior is characterized by the time between errors and the duration of errors. Based on this example data, the pin-level stuck-at fault model is found to deliver less than ideal performance. However, with respect to the class of faults which cause a system crash, the pin-level, stuck-at fault model is found to provide a good modeling capability. Author

N87-28026# Ames Lab., Iowa.
MICROSTRUCTURAL CHARACTERIZATION OF FERROMAGNETIC MATERIALS USING MAGNETIC NDE TECHNIQUES Ph.D. Thesis
R. Ranjan Jun. 1987 117 p
(Contract W-7405-eng-82)
(DE87-010918; IS-T-1231) Avail: NTIS HC A06/MF A01

Magnetic NDE techniques, e.g., the acoustic Barkhausen noise, the magnetic Barkhausen noise and the magnetic hysteresis curves, were simultaneously used for microstructural characterization of nickel and steels. Results showed that, in nickel, the non-180 degree domain walls interact more strongly with dislocations than the 180 degree domain walls. A study of the grain size effect on the magnetic and acoustic Barkhausen noises showed a great potential as a NDE grain size measurement tool. Moreover, the Barkhausen signals indicate that the 180 degree domain walls in nickel seem to have a stronger interaction with grain boundaries than the non-180 degree domain walls, as indicated by the acoustic Barkhausen signal. A model is proposed to explain the grain size effect on the Barkhausen signals. The model takes into account the density of magnetic domain walls and their initial velocity, with both quantities strongly dependent on microstructure. The Barkhausen noises were also found to be very sensitive to the change in carbide morphology. It is proposed that the magnetic Barkhausen peak signal is caused by mainly domain nucleation and the acoustic Barkhausen peak signal due to domain growth. DOE

N87-28027# Argonne National Lab., Ill.
ORIGIN OF SPURIOUS ULTRASONIC ECHOES IN STAINLESS STEEL PIPING WITH WELD OVERLAY
D. S. Kupperman Aug. 1986 10 p Presented at the Conference on Review of Progress in Quantitative NDE, San Diego, Calif., 3 Aug. 1986
(Contract W-31-109-eng-38)
(DE87-007009; CONF-860856-13) Avail: NTIS HC A02/MF A01

The initiation and growth of intergranular stress-corrosion cracking (IGSCC) in the heat affected zone (HAZ) of stainless steel reactor piping welds has been a subject of concern to electric utilities for over ten years. This type of crack can be detected with ultrasonic shear waves during normal maintenance periods with a reliability of up to 80%. Often after an inspection indicating cracks, a utility has been allowed to administer a temporary fix to a pipe which is suspected of being cracked. This fix is a weld metal overlay. The repaired pipes often have to be inspected after the overlay has been put on the pipe. The overlay with a complex, elastically anisotropic microstructure, considerably reduces the reliability of the ultrasonic inspection. This paper addresses the problems arising because of the overlay. DOE

N87-28028# Argonne National Lab., Ill.
HIGH-RESOLUTION COMPUTER TOMOGRAPHY FOR FLAW DETECTION IN ADVANCED THIN-LAYER CERAMICS FOR FUEL CELLS
B. D. Sawicka, W. A. Ellingson, and C. McPheeters Feb. 1987 26 p Presented at the 11th Annual Conference on Composites, Cocoa Beach, Fla., 18 Jan. 1987 Prepared in cooperation with Atomic Energy of Canada Ltd., Chalk River, Ontario
(Contract W-31-109-eng-38)
(DE87-011479; CONF-870172-3) Avail: NTIS HC A03/MF A01

Advanced monolithic solid oxide fuel cells are being assembled from thin (approx. 50m) tape-cast ceramic layers with highly tailored mechanical properties. The layers need to be free of cracks and nonbonds. A high-resolution computed tomography system with a Ir-192 source was investigated as a tool for detecting cracks and nonbonds. Results suggest that channel sizes, including internal channels, can be dimensional but that small in-plane cracks cannot be detected. DOE

N87-28029# Argonne National Lab., Ill.
NDE (NONDESTRUCTIVE EVALUATION) AND FRACTURE STUDIES OF HOT-PRESSED Si3N4
R. A. Roberts, J. P. Singh, and J. J. Vaitekunas Feb. 1987 21 p Presented at the 11th Annual Conference on Composites, Cocoa Beach, Fla., 18 Jan 1987
(Contract W-31-109-eng-38)
(DE87-011481; CONF-870172-4) Avail: NTIS HC A02/MF A01

This paper presents recent correlations of nondestructive evaluation (NDE) and fractography results to establish the relative effectiveness of various NDE techniques in detecting and identifying failure-causing flaws in hot-pressed Si3N4. Ultrasonic and low-kV x-ray data are compared with fractography results by means of digital image-processing techniques. DOE

N87-28030# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
APPLICABILITY OF FRACTURE MECHANICS TO LIFETIME PREDICTION OF B AND W CERAMIC HEAT EXCHANGER TUBES
W. G. Reuter Nov. 1986 101 p
(Contract DE-AC07-76ID-01570)
(DE87-012038; DOE/ID-10171) Avail: NTIS HC A06/MF A01

Fracture mechanics concepts are used to predict a minimum service lifetime for silicon carbide heat exchanger tubes to be tested in a prototype industrial heat recuperator installation. Available data and the assumptions used are identified, the analytical procedures are described, and the results and implications are discussed. The primary conclusion is that no evidence exists to indicate that the service lifetime is too short to be useful. Based on the assumption that K sub I less than K sub Th, the lifetime is unlimited for the specified initial flaw sizes. Additional conclusions relate to the scope and detail of further fracture mechanics studies necessary to more accurately predict service lifetimes for these ceramic materials. DOE

N87-28031# Dayton Univ., Ohio.
RESEARCH ON ADVANCED NDE (NONDESTRUCTIVE EVALUATION) METHODS FOR AEROSPACE STRUCTURES Final Report, 1 Sep. 1983 - 31 Aug. 1986
Robert J. Andrews, Brian G. Frock, Richard W. Martin, Jeffery A. Fox, and Edward L. Klosterman Apr. 1987 115 p
(Contract F33615-83-C-5036)
(AD-A182199; AFWAL-TR-87-4007) Avail: NTIS HC A06/MF A01 CSCL 11D

This report describes the development of new methods of ultrasonic nondestructive evaluation (NDE). Ultrasonic backscatter imaging and imaging using leaky surface waves are applied to locating defects in advanced fiber-reinforced composite materials. High speed digitizers are used to acquire the RF signals of interest and B-scan and C-scan images are generated using a high-precision, automated scanning system developed during this program. Defects such as matrix cracks, multi-level delaminations, ply cuts, and simulated porosity are identified in graphite/epoxy composite samples. Image analysis and digital image enhancement techniques are developed and applied to the digitized images to improve defect detection. Global and local spatial domain image operators are successful in improving spatial resolution and defect detection. Initial results of image segmentation efforts to isolate defects are encouraging. GRA

N87-28032# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
RELIABILITY ANALYSIS BASED ON EXPONENTIAL FAILURE DISTRIBUTIONS AND DEVELOPMENT OF A SUPPORTING COMPUTER ENVIRONMENT Ph.D. Thesis
Kenneth N. Cole 19 Dec. 1986 249 p
(AD-A182606; AFIT/DS/ENG/86-06) Avail: NTIS HC A11/MF A01 CSCL 14D

This investigation defines a generalized likelihood ratio test criteria for exponential failure distributions that is applicable to any number of samples with varying sample sizes. The formulas have been implemented in C- language computer programs as practical algorithms for reliability analysis. In addition, a software system has been developed that allows simple construction of programs that will generate tables of test criterial percentage points or automatically compute the test value for multiple data files and report the result of the test. The system includes a screen oriented editor working with a line compiler for generating the test programs. The software is designed to operate on the UNIX. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N87-28033# Army Armament Research and Development Command, Watervliet, N. Y. Close Combat Armaments Center.
SUMMARY OF THE PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON FRACTURE MECHANICS (17TH) HELD ON 7-9 AUG. 1984 IN ALBANY, NEW YORK Final Report
John H. Underwood, Richard Chait, C. W. Smith, David P. Wilhem, and Wayne R. Andrews Dec. 1986 30 p Symposium held in Albany, N.Y., 7-9 Aug. 1984
(AD-A181758; ARCCB-TR-86039) Avail: NTIS HC A03/MF A01 CSCL 20K

This report gives a brief summary of the Symposium and a more detailed description of the proceedings. A summary is given of each of the forty-four papers appearing in the proceedings. The papers are grouped into five categories used as session topics

at the Symposium: applications, subcritical crack growth, fracture testing, ductile fracture, and analysis and mechanisms. GRA

N87-28034# Sandia National Labs., Albuquerque, N. Mex.
DEVELOPMENTS IN MEASUREMENT TECHNIQUES FOR SHOCK-LOADED SOLIDS
L. C. Chhabildas and R. A. Graham 1987 18 p Presented at the Summer Meeting of the American Society of Mechanical Engineers, Cincinnati, Ohio, 14 Jun. 1987
(Contract DE-AC04-76DP-00789)
(DE87-007084; SAND-87-0505C; CONF-870637-3) Avail: NTIS HC A02/MF A01

Developments in measurement technique for study of wave profiles in shock-loaded solids over the past decade are reviewed and their influence examined. It is found that this period is characterized by considerable activity which has been concentrated on significant improvements to earlier developments. The most influential instrumental developments are noted and some perspective on the nature of the development of shock instrumentation is presented. DOE

N87-28035# Sandia National Labs., Albuquerque, N. Mex.
MULTI-POINT TRANSIENT MODAL TESTING
J. P. Lauffer, M. D. Tucker, and D. O. Smallwood 1987 8 p Presented at the Society for Experimental Mechanics Spring Meeting, Houston, Tex., 14 Jun. 1987
(Contract DE-AC04-76DP-00789)
(DE87-007085; SAND-87-0525C; CONF-870665-5) Avail: NTIS HC A02/MF A01

Recent advances in modal testing have made possible the measurement of frequency response functions using multiple uncorrelated random signals. This paper extends these concepts to multiple input transient testing. To allow the use of deterministic inputs, the theory of multiple input testing is first expanded and the conditions for the existence of a solution are examined. It is then shown that the addition of random delays to the inputs will satisfy the conditions for a solution. Finally, the technique is evaluated in two experiments. DOE

N87-28036 Purdue Univ., West Lafayette, Ind.
FORMULATION FOR SYMMETRICALLY LAMINATED BEAM AND PLATE FINITE ELEMENTS WITH SHEAR DEFORMATION Ph.D. Thesis
Alexander Te Chen 1986 92 p
Avail: Univ. Microfilms Order No. DA8709785

Finite element formulations were developed for symmetrically laminated composite beams and plates for static and free vibration analyses. First, a formulation, and efficient solution procedure, a microcomputer program, and a graphics routine for a 12 d.o.f. anisotropic symmetrically laminated beam finite element including the effect of shear deformation was introduced. The emphasis of the formulation and solution procedure was for simplicity, efficiency, and easy implementation on microcomputers. Second, an 18 d.o.f. triangular plate element in bending with anisotropic symmetrically laminated composite materials was formulated. To demonstrate and evaluate the present development, numerical computations on the static, free vibration, and buckling analyses of a series of anisotropic symmetrically laminated plate problems were performed using a microcomputer. Further testing and evaluation of the previously formulated beam element for more cases were conducted and the results compared with those obtained using the present plate elements. Finally, an approach was presented in the formulation of a 36 d.o.f. symmetrically laminated composite triangular plate element including the effect of shear deformation for free vibration. Dissert. Abstr.

N87-28037 Connecticut Univ., Storrs.
ELEVATED TEMPERATURE BIAXIAL FATIGUE Ph.D. Thesis
Chih Tung Chan 1986 227 p
Avail: Univ. Microfilms Order No. DA8709023

An experimental program for studying elevated temperature biaxial fatigue of a nickel based alloy, Hastelloy-X, is discussed. Effort was directed toward understanding multiaxial fatigue and correlating the experimental data to the existing theories of fatigue failure. It was discovered that the cracking mode switched from primary cracking on the maximum shear planes at room temperature to cracking on the maximum normal strain planes at 1200 F. New experimental evidence is presented that strongly supports the notion that the component of stress opening or closing cracks on maximum shear planes influences initiation fatigue life through friction effects as it is known to do in Mode 2 and 3 macrocrack propagation. Dissert. Abstr.

N87-28038 Wisconsin Univ., Madison.
DYNAMIC ANALYSIS AND DIAGNOSTIC MONITORING FOR HIGH SPEED SPINDLE-BEARING STRUCTURES Ph.D. Thesis
Yubao Chen 1986 280 p
Avail: Univ. Microfilms Order No. DA8703823

A new mathematical model for a rotating spindle-bearing structure was established. This model employs Timoshenko beam theory, with the gyroscopic moment due to rotating motion taken into account. A finite element formulation is carried out to seek the numerical solution. The Dynamic Data System (DDS) methodology is used, together with the finite element model after condensation, to estimate the bearing parameters. Then, the dynamic behavior of the spindle-bearing structure is investigated theoretically based on this model and experimentally via DDS modal analysis. A new time domain strategy is proposed and tested for diagnosing and monitoring rotating machinery using random vibration signatures. Dissert. Abstr.

N87-28039# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
STRUCTURAL OPTIMIZATION BY ROSEN'S GRADIENT PROJECTION METHOD
R. P. Notenboom Dec. 1984 39 p
(VTH-LR-450; B8707432; ETN-87-90199) Avail: NTIS HC A03/MF A01

The basic formulas and test cases of a structural optimization program are presented. The method confines the search direction to the intersection of those contraints found to be active at some stage of the design. This leads to the next design point, at which a new constraint may become active while another may become inactive. A new search direction is then computed and the process repeated. When the constraints are nonlinear it may be necessary to relinearize the constraints from time to time during the optimization procedure. Planar truss, redundant truss, and three bar truss are treated. ESA

N87-28040# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
STRESS DISTRIBUTION AT THE TIP OF AN INTERFACE CRACK BETWEEN AN ISOTROPIC AND AN ANISOTROPIC MATERIAL
M. L. C. E. Verbrugeen Jan. 1985 55 p
(VTH-LR-454; B8707436; ETN-87-90203) Avail: NTIS HC A04/MF A01

An analytical calculation program for the stress distribution at the tip of an interface crack between two dissimilar, anisotropic materials is presented. It is applied to an interface crack between an isotropic adhesive and an anisotropic prepreg (adhesive with unidirectional fibers parallel to the interface). Stress components are evaluated with respect to potential crack growth directions. Limitations of the results are considered. ESA

N87-28041# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
STABILITY ANALYSIS OF NONLINEAR VIBRATIONS OF IMPERFECT THIN-WALLED CYLINDERS
D. K. Liu and J. Arbocz Oct. 1986 19 p
(VTH-LR-461; B8707439; ETN-87-90206) Avail: NTIS HC A02/MF A01

Stability characteristics of the frequency-amplitude relationship for various thin walled cylinders are studied. The method of slowly varying parameters is used. The stability of the single mode and the coupled mode responses are investigated. In order to ensure the necessary accuracy the Newton-Raphson method was used.

Only the process of the investigation and the associated equations are presented. ESA

N87-28042*# Purdue Univ., West Lafayette, Ind. School of Mechanical Engineering.
OBSERVATIONS OF FATIGUE CRACK GROWTH RATE AND CLOSURE BEHAVIOR IN 7475-T731 ALUMINUM UNDER VARIABLE AMPLITUDE LOADING M.S. Thesis
Charles C. Turner and B. M. Hillberry 11 Apr. 1986 197 p
(Grant NAG1-231)
(NASA-CR-181240; NAS 1.26:181240) Avail: NTIS HC
A09/MF A01 CSCL 20K

Simultaneous measures of fatigue crack propagation rate and crack closure were taken from 7475-T731 aluminum alloy center cracked tensile specimens under variable amplitude loading conditions. Results indicate the presence of load interaction in a variety of repeated variable amplitude loading blocks. Load interaction results in retardation of the propagation rate for most loading blocks examined in the study. Closure did not explain observed delay behavior associated with high stress ratio and single peak overloads. Primary influences on the crack opening stress intensity level include the maximum stress intensity of the repeated loading block, the minimum stress intensity of the block, and the number of fatigue cycles between overloads of the block. Author

N87-28043*# Clemson Univ., S.C. Dept. of Mechanical Engineering.
FRACTURE AND CRACK GROWTH IN ORTHOTROPIC LAMINATES Final Report
James G. Goree and Autar K. Kaw 1 Dec. 1985 32 p
(Grant NsG-1297)
(NASA-CR-181247; NAS 1.26:181247) Avail: NTIS HC
A03/MF A01 CSCL 20K

A mathematical model based on the classical shear-lag assumptions is used to study the residual strength and fracture behavior of composite laminates with symmetrically placed buffer strips. The laminate is loaded by a uniform remote longitudinal tensile strain and has initial damage in the form of a transverse crack in the parent laminate between buffer strips. The crack growth behavior as a function of material properties, number of buffer-strip plies, spacing, width of buffer strips, longitudinal matrix splitting, and debonding at the interface is studied. Buffer-strip laminates are shown to arrest fracture and increase the residual strengths significantly over those of one material laminates, with S-glass being a more effective buffer strip material than Kevlar in increasing the damage tolerance of graphite/epoxy panels. For a typical graphite/epoxy laminate with S-glass buffer-strips, the residual strength is about 2.4 times the residual strength of an all graphite/epoxy panel with the same crack length. Approximately 50% of this increase is due to the S-glass/epoxy buffer-strips, 40% due to longitudinal splitting of the buffer strip interface and 10% due to bonding. Author

N87-28044*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
A COMPRESSIVE FAILURE MODEL FOR ANISOTROPIC PLATES WITH A CUTOUT UNDER COMPRESSIVE AND SHEAR LOADS Final Technical Report
Zafer Guerdal and Raphael T. Haftka 31 Dec. 1985 31 p
(Grant NAG1-601)
(NASA-CR-181264; NAS 1.26:181264) Avail: NTIS HC
A03/MF A01 CSCL 20K

Failure models for the prediction of compressive strength of plates with a hole are investigated. One of the models is based on the strength failure of the fibers that leads to fiber kinking failure. A different version is developed for cases where shear failure of the fibers is expected to be a dominate failure mode. Both models are capable of including the effects of combined shearing and compressive stresses around a hole in a plate and, therefore, are expected to be applicable to plates under combined shearing and compressive loadings, as well as anisotropic plates. Author

N87-28045*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
COMPONENT MODE SYNTHESIS AND LARGE DEFLECTION VIBRATION OF COMPLEX STRUCTURES. VOLUME 1: EXAMPLES OF NASTRAN MODAL SYNTHESIS CAPABILITY Final Report, period ending 31 Jan. 1987
Chuh Mei and Mo-How Shen Aug. 1987 50 p
(Grant NAG1-301)
(NASA-CR-181290; NAS 1.26:181290) Avail: NTIS HC
A03/MF A01 CSCL 20K

The use of NASTRAN model synthesis capability is illustrated. A classical truss problem is examined and the results are compared to results from other methods to test for accuracy. The problem is examined using both fixed interface modes and free interface modes. The solution is carried out for an applied dynamic load as far as recovery of forces in individual members as a function of time. Another small beam problem is used to compare different means of combining substructures. Author

N87-28046*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
COMPONENT MODE SYNTHESIS AND LARGE DEFLECTION VIBRATION OF COMPLEX STRUCTURES. VOLUME 2: SINGLE-MODE LARGE DEFLECTION VIBRATIONS OF BEAMS AND PLATES USING FINITE ELEMENT METHOD Final Report, period ending 31 Jan. 1987
Chuh Mei Aug. 1987 65 p
(Grant NAG1-301)
(NASA-CR-181291; NAS 1.26:181291) Avail: NTIS HC
A04/MF A01 CSCL 20K

A finite element method is presented for the large amplitude vibrations of complex structures that can be modelled with beam and rectangular plate elements subjected to harmonic excitation. Both inplane deformation and inertia are considered in the formulation. Derivation of the harmonic force and nonlinear stiffness matrices for a beam and a rectangular plate element are presented. Solution procedures and convergence characteristics of the finite element method are described. Nonlinear response to uniform and concentrated harmonic loadings and improved nonlinear free vibration results are presented for beams and rectangular plates of various boundary conditions. Author

N87-28047*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
COMPONENT MODE SYNTHESIS AND LARGE DEFLECTION VIBRATION OF COMPLEX STRUCTURES. VOLUME 3: MULTIPLE-MODE NONLINEAR FREE AND FORCED VIBRATIONS OF BEAMS USING FINITE ELEMENT METHOD Final Report, period ending 31 Jan. 1987
Chuh Mei and Mo-How Shen Aug. 1987 92 p
(Grant NAG1-301)
(NASA-CR-181292; NAS 1.26:181292) Avail: NTIS HC
A05/MF A01 CSCL 20K

Multiple-mode nonlinear forced vibration of a beam was analyzed by the finite element method Inplane (longitudinal) displacement and inertia (IDI) are considered in the formulation. By combining the finite element method and nonlinear theory, more realistic models of structural response are obtained more easily and faster. Author

N87-28048# Lawrence Livermore National Lab., Calif.
BRITTLE FRACTURE PHENOMENA: AN HYPOTHESIS
K. Britton and O. R. Walton 1 May 1987 24 p Presented at the 2nd International Symposium on Rock Fragmentation by Blasting, Keystone, Colo., 23 Aug. 1987
(Contract W-7405-eng-48)
(DE87-010247; UCRL-96585; CONF-870867-4) Avail: NTIS HC
A02/MF A01

It is proposed that: volumetric dilation is a fundamental requirement for brittle fracture involving shear; such dilation commonly involves or is expressed as zonal overpressures; the overpressured zones radiate particle motions which are significant to or dominate seismic radiation from blasting; the overpressures

are commonly significant to and may dominate the energetics of blastings. Outstanding problems and gaps in our knowledge regarding fragmentation are discussed. It is argued that there is a common missing factor, dilatancy. Supporting evidence is presented from soils and rock mechanics, blasting experimental data and blasting experience. Computer modeling of fragmentation is discussed and the necessity for the inclusion of dilatancy established. Implications are discussed and a test of the hypothesis proposed. DOE

N87-28049# Georgia Inst. of Tech., Atlanta. Fracture and Fatigue Research Lab.
A STUDY OF MECHANISMS OF TIME-DEPENDENT CRACK GROWTH AT ELEVATED TEMPERATURE Progress Report, Jul. 1986 - Jun. 1987
A. Saxena, S. R. Stock, B. Gieseke, and J. T. Staley 28 Feb. 1987 21 p
(Contract DE-FG05-86ER-45257)
(DE87-010952; DOE/ER-45257/1) Avail: NTIS HC A02/MF A01

Objective of this study is to conduct creep and creep-fatigue crack growth tests on Cu-Sb and to characterize the crack tip damage mechanisms in a model material which is known to cavitate at the grain boundaries under creep deformation. The data will be used to develop mechanistic models for cumulative crack tip damage under complex loading conditions at elevated temperature. The application of these models will also be extended to situations involving nonperiodic loading. The results of this program will be integrated into an EPRI study for characterizing the creep-fatigue crack growth behavior of Cr-Mo-V steels. Techniques to be used include electron metallography, x-ray and electron radiography and small angle neutron scattering (SANS). DOE

N87-28050# Sandia National Labs., Albuquerque, N. Mex.
ENVIRONMENTALLY-CONTROLLED FRACTURE
T. A. Michalske, B. C. Bunker, and D. Tallant 1987 4 p Presented at the Topical Symposium on Recent Developments in Ceramic Science, Albuquerque, N. Mex., 17 Jun. 1987
(Contract DE-AC04-76DP-00789)
(DE87-010954; SAND-87-1465C; CONF-8706123-2) Avail: NTIS HC A02/MF A01

Theoretical and experimental studies of oxide surface reactivity were combined to develop quantitative atomistic models for reactions which promote stress corrosion crack growth. These models address three basic processes influencing the structural reliability of ceramic materials: effects of mechanical strain and chemical environment on the kinetics of the crack tip bond rupture process, effect of surface reaction products on the structure and stress state at the crack tip, and chemical bonding mechanisms which can be used to heal fracture surfaces together. Silica glass was used in the studies. DOE

N87-28051# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
FATIGUE CRACK CLOSURE, OBSERVATIONS AND TECHNICAL SIGNIFICANCE
J. Schijve Apr. 1986 45 p Presented at the International Symposium on Fatigue Crack Closure, Charleston, W. Va., 1-2 May 1986
(VTH-LR-485; B8707458; ETN-87-90224) Avail: NTIS HC A03/MF A01

Mechanistic aspects of crack closure (differences between microcracks and macrocracks, microstructural influences); direct and indirect methods to measure crack closure; numerical aspects of crack closure relations for constant-amplitude loading; and crack closure and variable-amplitude loading are discussed. Changing crack growth mechanisms under threshold conditions and three dimensional aspects including plane strain/plane stress problems are considered. ESA

N87-28052# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
SEQUENCE EFFECTS OF HIGH-AMPLITUDE LOADS IN THE MOST SEVERE FLIGHTS OF MINITWIST ON FATIGUE CRACK GROWTH IN Al-ALLOY SHEET MATERIAL
U. H. Padmadinata Aug. 1968 27 p
(VTH-LR-493; B8707461; ETN-87-90226) Avail: NTIS HC A03/MF A01

Fatigue crack propagation was studied under modified miniTWIST load sequences applied to 2024-T3 alclad specimens to explore the sequence effect of the maximum amplitudes occurring in the most severe flights on fatigue. The main variable was the sequence of the high upward gusts and the high downward gusts. Tests were also carried out with the severe upward gusts occurring before the severe downward gusts (max-min) and with severe upward gusts occurring after the severe downward gusts (min-max). The modified min-max sequence gives slower crack growth than the max-min sequence. This trend qualitatively agrees with sequence effects observed in overload cycles. The max-min sequence gives a similar crack growth to the original miniTWIST. The severe flights give large contributions to the crack extension, followed by retardation in subsequent flights. The effect of an artificial starter crack has to be considered in crack growth prediction. ESA

N87-28053# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
INITIAL IMPERFECTION SURVEY ON A CYLINDRICAL SHELL (CSE) AT FOKKER B.V.
A. W. H. Klompe Sep. 1986 25 p
(VTH-LR-495; B8707463; ETN-87-90228) Avail: NTIS HC A02/MF A01

The results of the initial imperfection survey of a circular cylindrical shell, made of two sheets of aramid with a honeycomb in between, are presented. The modal components of the measured imperfection surface as a function of the circumferential and axial wave numbers are calculated. The characteristic imperfection distributions associated with the fabrication process used are presented. ESA

N87-28054# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
OBSERVATION ON CYCLIC DELAMINATION IN ARALL UNDER FATIGUE LOADING
G. H. J. J. Roebroeks Sep. 1986 14 p
(VTH-LR-496; B8707464; ETN-87-90229) Avail: NTIS HC A02/MF A01

Delamination in ARALL around growing fatigue cracks was studied by electron microscope. Clear delamination growth lines, each corresponding to one fatigue cycle are observed. This phenomenon might be interesting to use in studies of effects like variable amplitude loading and low frequency fatigue on delamination. ESA

N87-28055# Technische Hogeschool Twente, Enschede (Netherlands).
VIBRATIONS OF COAXIAL CYLINDRICAL BODIES IN AXIAL OR CROSS FLOW Ph.D. Thesis
Petrus Johannes Mari vanderHoogt 1986 213 p
(ISBN-90-71382-05-2; B8700462; ETN-87-90249) Avail: NTIS HC A10/MF A01

Flow-induced vibrations in arrays of straight parallel tubes in axial flow and in cross-flow were examined. In order to study the influence of a surrounding fluid on the eigenfrequency spectrum of tube bundles, a three-dimensional fluid-structure model is presented, and extended to account for the influence of an axially flowing fluid. An analytical model, based on potential flow approximation, of fluid-elastic instability is presented. Wind tunnel experiments, performed at various tube arrangements, are discussed. Dynamical features of the model are considered. Self-induced instabilities of the fluid-elastic type due to cross flow are treated. ESA

N87-28056*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE EFFECTS OF AEROELASTIC DEFORMATION ON THE UNAUGMENTED STOPPED-ROTOR DYNAMICS OF AN X-WING AIRCRAFT
Michael G. Gilbert and Walter A. Silva Jun. 1987 12 p Presented at the AIAA Atmospheric Flight Mechanics Conference, Monterey, Calif., 19 Aug. 1987
(NASA-TM-100480; NAS 1.15:100480) Avail: NTIS HC A02/MF A01 CSCL 20K

A new design concept in the development of VTOL aircraft with high forward flight speed capability is that of the X-Wing, a stiff, bearingless helicopter rotor system which can be stopped in flight and the blades used as two forward-swept and two aft-swept wings. Because of the usual configuration in the fixed-wing mode, there is a high potential for aeroelastic divergence or flutter and coupling of blade vibration modes with rigid-body modes. An aeroelastic stability analysis of an X-Wing configuration aircraft was undertaken to determine if these problems could exist. This paper reports on the results of dynamic stability analyses in the lateral and longitudinal directions including the vehicle rigid-body and flexible modes. A static aeroelastic analysis using the normal vibration mode equations of motion was performed to determine the cause of a loss of longitudinal static margin with increasing airspeed. This loss of static margin was found to be due to aeroelastic washin of the forward-swept blades and washout of the aft-swept blades moving the aircraft aerodynamic center forward of the center of gravity. This phenomenon is likely to be generic to X-Wing aircraft. Author

N87-28057*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INTRODUCTION TO THE COMPUTATIONAL STRUCTURAL MECHANICS TESTBED
C. G. Lotts, W. H. Greene, S. L. McCleary, N. F. Knight, Jr., S. S. Paulson (PRC Kentron, Inc., Hampton, Va.), and R. E. Gillian Sep. 1987 174 p
(NASA-TM-89096; NAS 1.15:89096) Avail: NTIS HC A08/MF A01 CSCL 20K

The Computational Structural Mechanics (CSM) testbed software system based on the SPAR finite element code and the NICE system is described. This software is denoted NICE/SPAR. NICE was developed at Lockheed Palo Alto Research Laboratory and contains data management utilities, a command language interpreter, and a command language definition for integrating engineering computational modules. SPAR is a system of programs used for finite element structural analysis developed for NASA by Lockheed and Engineering Information Systems, Inc. It includes many complementary structural analysis, thermal analysis, utility functions which communicate through a common database. The work on NICE/SPAR was motivated by requirements for a highly modular and flexible structural analysis system to use as a tool in carrying out research in computational methods and exploring computer hardware. Analysis examples are presented which demonstrate the benefits gained from a combination of the NICE command language with a SPAR computational modules. Author

N87-28058*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A COMPUTATIONAL PROCEDURE FOR AUTOMATED FLUTTER ANALYSIS
Durbha V. Murthy (Toledo Univ., Ohio.) and Krishna Rao V. Kaza Aug. 1987 17 p
(NASA-TM-100171; E-3736; NAS 1.15:100171) Avail: NTIS HC A02/MF A01 CSCL 20K

A direct solution procedure for computing the flutter Mach number and the flutter frequency is applied to the aeroelastic analysis of propfans using a finite element structural model and an unsteady aerodynamic model based on a three-dimensional subsonic compressible lifting surface theory. An approximation to the Jacobian matrix that improves the efficiency of the iterative process is presented. The Jacobian matrix is indirectly approximated from approximate derivatives of the flutter matrix. Examples are used to illustrate the convergence properties. The direct solution procedure facilitates the automated flutter analysis in addition to contributing to the efficient use of computer time as well as the analyst's time. Author

N87-28059*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Composite Materials and Structures.
NONLINEAR ANALYSIS FOR THE RESPONSE AND FAILURE OF COMPRESSION-LOADED ANGLE-PLY LAMINATES WITH A HOLE Interim Report No. 65
Steven R. Mathison, Carl T. Herakovich, Marek-Jerzy Pindera, and Mark J. Shuart Jul. 1987 239 p
(Grant NAG1-343)
(NASA-CR-181288; NAS 1.26:181288; CCMS-87-12; VPI-E-87-14) Avail: NTIS HC A11/MF A01 CSCL 20K

The objective was to determine the effect of nonlinear material behavior on the response and failure of unnotched and notched angle-ply laminates under uniaxial compressive loading. The endochronic theory was chosen as the constitutive theory to model the AS4/3502 graphite-epoxy material system. Three-dimensional finite element analysis incorporating the endochronic theory was used to determine the stresses and strains in the laminates. An incremental/iterative initial strain algorithm was used in the finite element program. To increase computational efficiency, a 180 deg rotational symmetry relationship was utilized and the finite element program was vectorized to run on a supercomputer. Laminate response was compared to experimentation revealing excellent agreement for both the unnotched and notched angle-ply laminates. Predicted stresses in the region of the hole were examined and are presented, comparing linear elastic analysis to the inelastic endochronic theory analysis. A failure analysis of the unnotched and notched laminates was performed using the quadratic tensor polynomial. Predicted fracture loads compared well with experimentation for the unnotched laminates, but were very conservative in comparison with experiments for the notched laminates. Author

N87-28060# Hanford Engineering Development Lab., Richland, Wash.
ELASTIC CREEP-FATIGUE EVALUATION FOR ASME CODE
L. K. Severud and B. V. Winkel Feb. 1987 9 p Presented at the 9th SMIRT: International Conference on Structural Mechanics in Reactor Technology, Lausanne, Switzerland, 17 Aug. 1987
(Contract DE-AC06-76FF-02170)
(DE87-009968; HEDL-SA-3673-FP; CONF-870812-12) Avail: NTIS HC A02/MF A01

Reassessment of past ASME N-47 creep-fatigue rules has been under way by committee members. The new proposed elastic creep-fatigue methods are easier to apply than those previously in the code case. They also provide a wider range of practical application while still providing conservative assessments. It is expected that new N-47 code rules for elastic creep-fatigue evaluation will be adopted in the near future. DOE

N87-28061# Sandia National Labs., Albuquerque, N. Mex.
RANDOM CONTROL AT n2 POINTS USING n SHAKERS
Thomas L. Paez, David Smallwood, and Edward Buska 1987 14 p Presented at the Institute of Environmental Sciences Annual Meeting, San Jose, Calif., 4 May 1987
(Contract DE-AC04-76DP-00789)
(DE87-005849; SAND-86-2774C; CONF-870566-2) Avail: NTIS HC A02/MF A01

Until recently, random vibration tests performed in the laboratory were typically run using single point control with the excitation generated using one vibration exciter. Recently, a method was developed for the coherent control of multiple vibration exciters. This new method for testing permits the simultaneous control of the autospectral density of motion at n points on a structure, and the cross spectral density of motion between every pair of control points. It is shown that use of the present control technique also permits random vibration control of the autospectral density at n sup 2 points during an n-shaker test. DOE

N87-28062# Queensland Univ., St. Lucia (Australia). Dept. of Civil Engineering.
INELASTIC BUCKLING OF WELDED MONOSYMMETRIC I-BEAMS
S. Kitipornchai and A. D. Wong-Chung Dec. 1985 39 p
(RR-CE66) Avail: NTIS HC A03/MF A01

The inelastic buckling of welded monosymmetric I-beams under uniform moment was investigated. The assumed welding residual stress is based on the so-called tendon force concept developed by the Cambridge group. The residual stresses are shown to be dependent on the connecting plate sizes, weld areas, and the welding process. The assumed residual stress pattern consists of a fully yielded tensile stress block of width 2c in the flange at the weld, and a constant residual compressive stress sigma sub c at the outer edges to maintain equilibrium. The influences of the degree of the beam monosymmetry, rho, and the values of c are examined. It is shown that the inelastic buckling capacities decrease with rho and with increasing c values. Theoretical inelastic buckling moments compared well with Fukumoto's test results, except for the very high strength grade steel. Present inelastic beam design rules in AS1250, AISC specifications, ECCs and BS5950 are reviewed. A simple method of determining the inelastic buckling moment for welded monosymmetric I-beams is proposed. Author

N87-28063# Naval Postgraduate School, Monterey, Calif.
A COMPARISON OF TRIPPING BEHAVIOR OF WIDE AND NARROW FLANGED T AND Z STIFFENED PANELS M.S. Thesis
Robert B. Miller Mar. 1987 141 p
(AD-A181890) Avail: NTIS HC A07/MF A01 CSCL 13J

An experimental investigation was conducted to study the dynamic instability and tripping characteristics of specific stiffened rectangular flat plate design due to hydrostatic and impulsive loading. The air backed test panels were constructed of 6061-T6 aluminum with externally machined longitudinally, wide flanged T or Z stiffeners and were tested under clamped boundary conditions. Test panel loading was provided by a manual hydropump for static testing and by the underwater detonation of an eight pound, cylindrical TNT charge for the dynamic test. The static test panel was instrumented to measure pressure, strain and plate deflection. The dynamic test panel was instrumented to measure transient strains and free-field pressure. The data obtained from these tests was qualitatively analyzed and compared to the results of geometrically similar narrow flanged T stiffened panel results currently available in the literature. GRA

N87-28064# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ADIABATIC SHEAR BANDS IN SIMPLE AND DIPOLAR PLASTIC MATERIALS
Thomas W. Wright and Romesh C. Batra Mar. 1987 29 p
(AD-A182034; BRL-MR-3569) Avail: NTIS HC A03/MF A01 CSCL 11I

A simple version of thermo/viscoplasticity is used to model the formation of adiabatic shear bands in high rate deformation of solids. The one-dimensional shearing deformation of a finite slab is considered. Equations are formulated and numerical solutions are found for dipolar plastic materials. These solutions are contrasted and compared with previous solutions for simple materials. GRA

N87-28065# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
PROCESSING AND PROPERTIES OF AIRFRAME MATERIALS Final Report, 1 Jan. 1983 - 28 Feb. 1986
C. G. Rhodes, J. C. Chestnutt, J. A. Wert, and A. K. Ghosh Jun. 1987 119 p
(Contract F49620-83-C-0055)
(AD-A182159; SC5358-4FR; AFOSR-87-0815TR) Avail: NTIS HC A06/MF A01 CSCL 01C

This report describes the results of a three-year research program to study the relationship between microstructure and processing conditions and the effects of processing conditions on the performance of structural airframe materials. Part 1 of the program was an examination of the influence of beta processing methods on the interaction of fatigue cracks with microstructural elements. These beta-phase processing methods were chosen to provide variations in beta-phase volume fraction and continuity, alpha plate size, and alpha colony size in plate and forging material. The microstructures of the beta-processed materials were quantitatively characterized using scanning electron microscopy (SEM) and scanning transmission electron microscopy (STEM). Linear regression analyses revealed that beta phase volume fraction was most influential and colony size least influential on fatigue crack growth rates. GRA

N87-28066# California Univ., Los Angeles. Dept. of Civil Engineering.
INTERACTION OF TWO SLIP PLANES ON EXTRUSION GROWTH IN FATIGUE BAND
T. H. Lin, S. R. Lin, and X. Q. Wu 1987 29 p
(Contract N00014-86-K-0153)
(AD-A182288; UCLA-ENG-87-11) Avail: NTIS HC A03/MF A01 CSCL 11F

The micromechanic theory of fatigue crack initiation is reviewed. Intrusions and extensions have been observed in fatigue specimens. An initial stress field favorable for the growth of extrusion or intrusion can be produced by arrays of dislocation dipoles. These dipoles caused an initial tensile strain giving an elongation which is called the static extrusion growth terminates. Along the direction of an extrusion, tensile strain and tensile stress occurs. The tensile stress caused the resolved shear stress to reach critical and slide in a secondary slip system. The slip causes plastic tensile strain which increases significantly the extrusion growth. Similarly the same mechanism exists for the growth of intrusions. This explains why extrusions grow much more than the static extrusion. GRA

N87-28067# Lehigh Univ., Bethlehem, Pa.
ANALYSIS OF STRUCTURES WITH ROTATING, FLEXIBLE SUBSTRUCTURES
A. S. Hopkins and Peter Likins 1987 11 p
(AD-A182318) Avail: NTIS HC A02/MF A01 CSCL 20K

A new method has been developed for dynamic analysis of flexible structures, parts of which may be experiencing discrete motion relative to other parts. This method provides the capability of representing the continuum deformations typically treated using finite element methods. It also provides the capability of representing the discrete motion at joints traditionally available with multibody methods. After decomposing the structure into substructures and associating a frame of reference with each substructure, the equations of motion for each substructure can be written explicitly including contributions due to the frame of reference generalized coordinates. By expanding the set of constraints to include constraints that eliminate the redundancy introduced by the frame generalized coordinates, the equations of motion become amenable to solution. The first digital computer program using this method, the General Rotorcraft Aeromechanical Stability Program (GRASP), was introduced in 1986. Although GRASP is limited to applications involving steady-state-rotation, extension to arbitrary motions (including spin-up) can be accomplished. GRA

N87-28068*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THERMAL-STRESS-FREE FASTENERS FOR JOINING ORTHOTROPIC MATERIALS
M. L. Blosser Aug. 1987 11 p Presented at the AIAA 22nd Thermophysics Conference, Honolulu, Hawaii, 8-10 Jun. 1987
(NASA-TM-100489; NAS 1.15:100489) Avail: NTIS HC A02/MF A01 CSCL 20K

Hot structures fabricated from orthotropic materials are an attractive design option for future high speed vehicles. Joining subassemblies of these materials with standard cylindrical fasteners can lead to loose joints or highly stressed joints due to thermal stress. A method has been developed to eliminate thermal stresses

and maintain a tight joint by shaping the fastener and mating hole. This method allows both materials (fastener and structure), with different coefficients of thermal expansion (CTEs) in each of the three material directions, to expand freely with temperature yet remain in contact. For the assumptions made in the analysis, the joint will remain snug, yet free of thermal stress at any temperature. Finite element analysis was used to verify several thermal-stress-free fasteners and to show that conical fasteners, which are thermal-stress-free for isotropic materials, can reduce thermal stresses for transversely isotropic materials compared to a cylindrical fastener. Equations for thermal-stress-free shapes are presented and typical fastener shapes are shown. Author

N87-28069 Central Electricity Generating Board, London (England). Translation Section, Overseas Service.
DISTRIBUTION OF RESIDUAL WELDING STRESSES IN LARGE REPAIR WELDS IN CASINGS COMPRISING CREEP-RESISTANT STEEL
S. I. German 3 Aug. 1987 14 p Transl. into ENGLISH from Metals in Modern Power Generating Plants, Energia (Moscow, USSR), 1977 p 36-39
(CE-Trans-8271; BLL-CEGB-9022.09) Avail: Issuing Activity

The results are presented obtained from studying the fields of residual stresses arising throughout the entire volume in the process of carrying out repair welds to considerable excavations of metal in test pieces simulating thick walled, solid castings made from 15Cr1Mo1V (cast) type steel. In slabs measuring 400 x 400 x 150 mm excavations were made amounting to 150 x 150 x 70 mm, which were then welded up with TsL-20 type pearlitic electrodes and TsL-25 type austenitic electrodes. An assessment was made of the effect of various technological repair weld regimes (peening, preheating), and also of high temperature tempering on the nature of the distribution of residual weld stresses. Experiments were conducted in five different versions of making repair welds with TsL-20 type electrodes. Results are given and discussed. Author

N87-28070*# National Aeronautics and Space Administration, Washington, D.C.
THERMOPLASTICITY OF COUPLED BODIES IN THE CASE OF STRESS-DEPENDENT HEAT TRANSFER
O. A. Kilikovskaya Aug. 1987 17 p Transl. into ENGLISH from Uprugost' i Neuprugost' (USSR), no. 3, 1973 p 47-60 Original language document was announced in IAA as A73-39327 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TT-20110; NAS 1.77:20110) Avail: NTIS HC A02/MF A01 CSCL 20K

The problem of the thermal stresses in coupled deformable bodies is formulated for the case where the heat-transfer coefficient at the common boundary depends on the stress-strain state of the bodies (e.g., is a function of the normal pressure at the common boundary). Several one-dimensional problems are solved in this formulation. Among these problems is the determination of the thermal stresses in an n-layer plate and in a two-layer cylinder. IAA

N87-28071 Virginia Polytechnic Inst. and State Univ., Blacksburg.
DETERMINATION OF THE COMPLEX MODULUS OF A SOLID PROPELLANT AND RANDOM VIBRATION ANALYSIS OF LAYERED VISCOELASTIC CYLINDERS WITH FINITE ELEMENT METHOD Ph.D. Thesis
Hsing-Juin Lee 1987 165 p
Avail: Univ. Microfilms Order No. DA8712386

Aeronautical structures, such as aircraft or missiles, are usually highly sophisticated systems often subjected to random vibration environment. Thus, in various design, development, and production stages, laboratory random vibration testing of sampled solid rocket motors on electromagnetic or hydraulic shakers are routinely performed as an important experiment-oriented quality control strategy. A methodology was developed to deal with the random vibration of a general class of composite structures with frequency dependent viscoelastic material properties as represented by the example of solid rocket motors. The method combines the finite element method, structural dynamics, strain energy approach, and random vibration analysis concepts. Before the random vibration analysis could proceed, a microcomputer-based dynamic mechanical analyzer system was used together with time-temperature superposition principle to obtain the frequency-dependent dynamic viscoelastic properties of the solid propellant. Modal analysis data together with half power band width calculated at each natural frequency are highly useful guides in the harmonic analysis to achieve computational efficiency. Dissert. Abstr.

N87-28072 Virginia Polytechnic Inst. and State Univ., Blacksburg.
GEOMETRIC AND MATERIAL NONLINEAR EFFECTS IN ELASTIC-PLASTIC AND FAILURE ANALYSES OF ANISOTROPIC LAMINATED STRUCTURES Ph.D. Thesis
Dave Robert Rourk 1986 90 p
Avail: Univ. Microfilms Order No. DA8711003

An analytical procedure to predict the strength and failure of laminated composite structures under monotonically increasing static loads is presented. A degenerated 3-D shell finite element that includes linear elastic and plastic material behavior with full geometric nonlinearity is used to determine stresses at selected points of the structure. Material stiffness matrices are evaluated at each Gauss point, in each lamina, and in each element, and when the computed stress state violates a user selected failure criterion the material stiffness matrix at the failed Gauss point is reduced. The reduction procedure involves setting the material stiffnesses to unity. Examples of isotropic, orthotropic, anisotropic, and composite laminates are presented to illustrate the validity of the procedure developed and to evaluate various failure theories. The results indicate that for large length to thickness ratios, the geometric nonlinear effect should be incorporated for both isotropic and anisotropic structures. The nonlinear material model influences the behavior of isotropic structures with small length to thickness ratios, while have nearly no effect at all on laminated anisotropic structures. Dissert. Abstr.

N87-28381# Joint Publications Research Service, Arlington, Va.
QUASI-RESONANCES IN PROBLEM OF FORCED VIBRATIONS FOR THIN ELASTIC SHELL INTERACTING WITH FLUID Abstract Only
D. G. Vasilyev and V. B. Lidskiy *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 16 Transl. into ENGLISH from Funktsionalnyy Analiz i Ego Prilozheniya (Moscow, USSR), v. 20, no. 4, Oct. - Dec. 1986 p 17-28 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

42 GEOSCIENCES (GENERAL)

N87-28073# Joint Publications Research Service, Arlington, Va.
USSR REPORT: EARTH SCIENCES
4 Mar. 1987 94 p Transl. into ENGLISH from various Russian articles
(JPRS-UES-87-001) Avail: NTIS HC A05/MF A01

Abstracts of articles addressing various topics in the Earth sciences are presented. The general subject areas include meteorology, oceanography, terrestrial geophysics, atmospheric physics, and arctic and antarctic research. For individual titles, see N87-28074 through N87-28091.

N87-28074# Joint Publications Research Service, Arlington, Va.
DISTRIBUTION OF ATMOSPHERIC METHANE CONCENTRATION OVER DIFFERENT TECTONIC REGIONS Abstract Only **c46**
Ye. V. Stadnik, I. Ya. Sklyarenko, I. S. Guliyev, and A. A. Feyzullayev *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 1 Transl. into ENGLISH from Doklady Akademii Nauk SSSR

(Moscow, USSR), v. 289, no. 3, Jul. 1986 p 703-705 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

Measurements of atmospheric methane concentrations were made over the territories of Donetsk and Rostov Oblasts, Krasnodarsk Kray, the Uzbek, Kazakh, Turkmen, Azerbaijan, Georgian and Armenian republics. About 400 measurements were made at altitudes of 50 to 5,000 m. With transition from geosynclinal regions to ancient platforms there is a distinct decrease in methane concentration in the lower layers, attributable to different geological and tectonic conditions for the migration of methane into the atmosphere. Ancient platforms are tectonically quiet and subvertical migration processes are difficult. In geosynclinal regions there are favorable conditions for the subvertical migration of lithospheric gases due to the revival of existing and appearance of new fractures, dislocations and faults. The data demonstrated a definite influence of geotectonic conditions on formation of the atmospheric methane field. There is a distinct relationship between atmospheric methane concentration and the presence of petroleum- and gas-bearing structures beneath the Earth's surface. The geotectonic factor exerts an influence on methane concentration to the level 2,000 to 2,500 m. The presence of petroleum and gas in the underlying geological formations is reflected only in the lower layers of the atmosphere (up to 50 to 150 m). Author

N87-28075# Joint Publications Research Service, Arlington, Va.
REEXAMINATION OF IDEAS RELATING TO CARBON DIOXIDE PROBLEM Abstract Only. **c45**
S. P. Gorshkov *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 2 Transl. into ENGLISH from Izvestiya Vsesoyuznogo Geofraficheskogo Obshchestva (Leningrad, USSR), v. 118, no. 4, Jul. - Aug. 1986 p 297-305 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

There is great uncertainty concerning the quantity of carbon dioxide annually produced by man's economic activity. But it is unanimously agreed that with an increase in the quatity of CO2 there should be an increase in the yield of agricultural crops. A statistical analysis indicates that the annual emission of anthropogenic CO2 (C) into the atmosphere in the late 1970's to early 1980's was about 11 billion tons/year and therefore the annual atmospheric increment of CO2 concentration should be 5.2 million(-1). However, since during this time the annual CO2 increment on the average did not exceed 1.4 million(-1) it appears that the atmosphere retains about 30% of the anthropogenic emission of CO2. Those authors who assume that the combustion of fossil fuel gives 70 to 80% of the anthropogenic contribution to CO2 content contend that up to 50% of this gas is retained by the atmosphere, this being based on a definite underevaluation of anthropogenic reduction of the biosphere. Almost 8 billion tons of CO2 remain unaccounted for. It is believed that ocean waters are the main absorbers of anthropogenic CO2, but it is entirely probable that land biota and the soil cover are becoming assimilators of excess atmospheric CO2. Author

N87-28076# Joint Publications Research Service, Arlington, Va.
EDDY-RESOLVING MODEL OF NORTH ATLANTIC CURRENTS Abstract Only. **c48**
D. G. Seidov, A. D. Marushkevich, and D. A. Nechayev *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 11-12 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 289, no. 4, Aug. 1986 p 980-983 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

An eddy-resolving circulation model was proposed in order to clarify the applicability of the conclusions drawn from idealized research to study the significance of synoptic variability in ocean circulation. The model was used to obtain preliminary results of computations of hydrophysical fields in the North Atlantic with allowance for their synoptic variability. A model proposed earlier is reduced to solution of three prognostic equations for evolution of the fields of temperature, salinity, and relative vorticity of total flows. Model prognostic experiments were carried out for simulating currents in a limited region to the west of the mid-oceanic ridge, followed by diagnostic and prognostic experiments for the entire North Atlantic. The results are indicative of the importance of synoptic variability in the structure and dynamics of macroscale hydrophysical fields in the ocean. Author

N87-28077# Joint Publications Research Service, Arlington, Va.
MORPHOMETRIC STUDIES OF WORLD OCEAN Abstract Only. **c48**
K. A. Zvonarev and Ye. G. Kapralov *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 12 Transl. into ENGLISH from Vestnik Leningradskogo Universiteta, Seriya 7: Geologiya, Geografiya (Leningrad, USSR), no. 3, Sep. 1986 p 50-57 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

Literature of morphometric studies of the world ocean is reviewed, with emphasis on the work of E. Kossina, M. Groll, O. Kruemmel, H. W. Menard, and S. M. Smith. The most recent data indicate that about 16% of the area of the ocean has been studied to such a degree that bottom relief forms can be mapped precisely, another 22% is mappable only with the principal relief forms, whereas the remaining area has been studied only very approximately. Many significant contributions to morphometric study of the ocean have been made during the last decade by specialists at Leningrad State University, Moscow State University and the Oceanology Institute, but also by many other Soviet and foreign authors and organizations. Unfortunately, all these studies have been made using different methods and with unlike accuracy. As the degree of study of the ocean floor increases and its shoreline is plotted more precisely there has been an increase in the number of the principal quantitative characteristics used in describing relief of the ocean floor. More and more studies are appearing which give the statistical characteristics of relief, the indices of vertical and horizontal dissection and orientation of the bottom surface, as well as shoreline length and sinuosity, but most are limited to small areas and the range of initial data used is extremely small. Author

N87-28078# Joint Publications Research Service, Arlington, Va.
NUMERICAL MODELING OF SEASONAL VARIABILITY OF WORLD OCEAN Abstract Only. **c48**
V. I. Klimok, V. P. Kochergin, and G. Fridrikh *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 15 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Atmosfery i Okeana (Moscow, USSR), v. 22, no. 9, Sep. 1986 p 940-947 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

The seasonal variability of the world ocean was computed by numerical integration of the full nonlinear equations of hydrothermodynamics. Conservative difference schemes are used in the process, allowance being made for the upper quasi-homogeneous layer and real bottom relief. The computations were made for the area of the world ocean from 67.5 deg N to 65.5 deg S using a 5 deg grid in horizontal coordinates and a nonuniform vertical grid to a depth of 1,000 m and from 1,000 to 5,000 m with a uniform grid with a 500-m interval. A numerical experiment was carried out in three stages. The first stage began with the ocean at a state of rest and with a climatic distribution of the temperature field for September; computations for this variant were made for 11 years model time. The second stage involved solution of the seasonal variability problem using data taken from solution of the first stage; the nonstationary problem was calculated for 20 years. In the third stage seasonal variation was determined with allowance for real bottom relief; computations were made for 20 years model time using the initial field obtained in the second stage. Nonlinear terms were taken into account. The model computations show that the simulated hydrothermodynamic characteristics are entirely consistent with prevailing concepts. The model gives the correct seasonal variations in heat transport across the equator and can be used in more detailed study of the mechanisms of heat transport by ocean currents, assuming improvement in horizontal resolution. Author

N87-28079# Joint Publications Research Service, Arlington, Va.
ANALYSIS OF SERIES OF CONVECTIVE STEPS IN TEMPERATURE INVERSION IN SEA Abstract Only. c48
K. N. Fedorov, V. T. Paka, G. R. Gamsakhurdiya, and M. V. Yemelyanov *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 16 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Atmosfery i Okeana (Moscow, USSR), v. 22, no. 9, Sep. 1986 p 969-978 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

A distinct stepped structure in the temperature inversion layer was discovered in the Ionian Sea to the south of the Peloponnesus in October 1983. This stepped structure consisted of 20 mixed convective layers with thicknesses from 1.5 to 8.2 m in the 210 to 310-m layer. The inversion layer was situated between relatively freshened and cold waters with a minimum temperature 14.57 C at 210 m and a minimum salinity of 38.60 deg/oo at 160 m and warmer more saline waters with a maximum temperature of 14.80 C at the horizon 310 m and a maximum salinity of 38.78 deg/oo at 410 m. It was determined that this stepped inversion layer stratification is attributable to a meandering front of a thermoclinal character. A detailed study was made of the conditions for its formation and the resulting heat and mass exchange through the corresponding layers. Author

N87-28080# Joint Publications Research Service, Arlington, Va.
FAULTS IN NORTHERN PART OF CENTRAL ATLANTIC Abstract Only c48
A. O. Mazarovich *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 17-18 Transl. into ENGLISH from Geotektonika (Moscow, USSR), no. 5, Sep. - Oct. 1986 p 25-34 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

In the northern part of the Central Atlantic faults penetrate to depths as great as 11 to 16 km. Within this region the crust is broken by numerous faults in several systems oriented in different directions. One system is made up of giant sublatitudinal faults intersecting all the structural zones of the present-day Atlantic. They are characterized by a complex morphology and are of different age along the strike. The distribution of heat flow and present-day earthquake epicenters indicates their activity both within the limits of the mid-oceanic ridge and in abyssal basins. Another system is formed of numerous faults associated with longitudinal structures of the mid-oceanic ridge. Its relationship to the first system indicates that during the course of Atlantic Ocean development there was activation along one and then along the other. A third system is made up of fault dislocations which developed only in thalassogens. The different morphology of the structures and their orientation are indicative of a great nonuniformity of the crust in abyssal basins. Still another system developed within the passive continental margins of the Atlantic Ocean. A fifth system is bordered by a zone of fault structures genetically associated with oceanogenesis processes. Deformations formed during horizontal tectonic stratification of the oceanic lithosphere at different levels constitute a special system. All this indicates a great mobility of the crust and deeper horizons, contradicting the idea that there is a great rigidity and monolithicity of lithospheric plates. Author

N87-28081# Joint Publications Research Service, Arlington, Va.
STATE-OF-ART AND PROSPECTS FOR DEVELOPING EQUIPMENT FOR MEASURING HYDROLOGICAL PARAMETERS IN WORLD OCEAN Abstract Only c48
T. K. Izmailov, A. M. Izmaylov, and F. M. Allakhverdov *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 23 Transl. into ENGLISH from Izmereniya, Kontrol, Avtomatizatsiya (Moscow, USSR), no. 4, Jul. - Aug. 1986 p 3-11 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

A review of the present status of production of instrumentation for measuring hydrological parameters in the world ocean reveals numerous deficiencies which are inconsistent with effective oceanological research on a global scale, which are economically unjustifiable and make comparison of research carried out by different organizations difficult. It is proposed that most of the nonstandardized equipment be replaced by a standardized series of precise ultrasonic hydrological instruments which can be employed in measuring the most important hydrological parameters of the ocean. The ultrasonic measuring method is not yet widely employed in hydrological instruments largely due to a bias toward traditional methods, inadequate knowledge of ultrasonic principles among oceanologists, difficulty in designing the required piezoelectric transducers for oscillations ensuring absence of acoustic noise, and lack of suitable integrated microcircuits. Many of these problems have been solved or are being rectified. Instrumentation exemplifying the possibility of such devices are described. Author

N87-28082# Joint Publications Research Service, Arlington, Va.
VISCOUS DRAG OF OCEANIC LITHOSPHERE Abstract Only c48
V. P. Trubitsyn and A. S. Fradkov *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 24-25 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Zemli (Moscow, USSR), no. 6, Jun. 1986 p 3-16 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

A study was made of the structure of thermal convection under the moving lithosphere in the subduction process. The mechanical interaction of flows with the lithosphere is modeled using a stipulated rate of horizontal movement at the upper boundary of the viscous mantle and vertical velocity at the side walls. This is followed by a determination of convection rates and temperatures in the upper mantle and distribution of viscous cohesion forces for different intensities of convection, rate of lithosphere movement and subduction depth. On this basis it was possible to find the critical rates of movement of the oceanic lithosphere at which the convection currents in the upper mantle are restructured. Emphasis is on the range of rates of lithospheric movement less than the characteristic velocity of viscous flows, corresponding to a case when the lithospheric plate experiences drag due to interaction with adjacent plates and the less active continental mantle. The cohesion between the moving lithosphere and viscous mantle results in a broadening of convective eddies rotating in the direction of movement of the lithosphere and the suppression of countereddies. With an increase in the rate of lithospheric movement the eddies are joined together, forming a single eddy beneath the entire lithospheric plate. Author

N87-28083# Joint Publications Research Service, Arlington, Va.
GEOLOGICAL AND GEOPHYSICAL COROLLARIES OF OCEANIC LITHOSPHERE SERPENTINIZATION Abstract Only c48
L. I. Lobkovskiy, V. N. Nikolayevskiy, and A. V. Karakin *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 25-26 Transl. into ENGLISH from Byulleten Moskovskogo Obshchestva Ispytateley Prirody: Otdel Geologicheskiy (Moscow, USSR), v. 61, no. 4, Jul. - Aug. 1986 p 3-12 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

A two-level model of structure of the 3d oceanic layer, based on the modified Hess hypothesis, supplemented by modern concepts on formation of the 2d (basaltic) and upper part of the 3d (gabbro) layers of the oceanic crust in the axial spreading zone, appears to be logically rigorous and best supported by observational data. However, it requires quantitative validation and an explanation of the fact that the thickness of the 3d layer on the average increases by only 2-3 km, whereas the 500 C isotherm drops by a depth of about 30-40 km over the course of 100 million years. The unusual distribution of foci of intermediate earthquakes (in the depth range from 50 to 250 km) beneath island arcs is associated with the process of deep serpentinization of a plunging lithospheric plate. In a number of island arcs the hypocenters of intermediate earthquakes have a tendency to be arranged in the form of two parallel focal surfaces, one of which coincides with the surface of the plunging plate, whereas the other

runs approximately in the middle of the plate and is 30 to 40 km from the first. Whereas the focal mechanisms of the upper focal surface correspond to compression oriented in the direction of plate plunging, the focal mechanisms of earthquakes at the lower surface correspond to dilitation in this same direction. Although existing models of a plunging plate qualitatively explain the focal mechanisms of intermediate earthquakes, they cast no light on the reason for stratification of the Wadati-Zavaritskiy-Benioff zone at two parallel surfaces. The concept of intensive serpentinization of the lithosphere can be applied in explaining the development of the double focal zone. Author

N87-28084# Joint Publications Research Service, Arlington, Va.
DESCRIPTION OF NORTH ATLANTIC BASEMENT Abstract Only **c48**
N. Ya. Kunin and S. V. Usenko *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 27 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Zemli (Moscow, USSR), no. 7, Jul. 1986 p 3-15 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

In the North Atlantic there have been more than 400 deep seismic soundings which provide data on the seismic section to the M discontinuity, in all cases with discrimination of the oceanic third layer. The results of analysis of lateral changes in thickness and boundary velocity of the North Atlantic basement using materials updated to mid-1983 are presented. Histograms and maps of the analyzed parameters were prepared for individual geomorphological structures, for the ocean floor, for the western and eastern transition zones and for the North Atlantic as a whole. Within the limits of the continental margins there is a narrow range of thickness of the magma-metamorphic crust which can be interpreted as the zone of sharp transition from the continent to the ocean. Most importantly, all the presented data fail to indicate presence of any bilateral symmetry in crustal structure, which is an indispensible condition for the spreading hypothesis. Author

N87-28085# Joint Publications Research Service, Arlington, Va.
RESONANCE PHENOMENA IN FLUID MEDIA Abstract Only **c34**
A. T. Lukyanov, V. M. Inyushin, and A. P. Gorokhov *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 31-32 Transl. into ENGLISH from Vestnik Akademii Nauk Kazakeskoy SSR (Alma-Ata, USSR), no. 7, Jul. 1986 p 14-15 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

Studies were made to detect the presence of a memory in fluid media. The experiments revealed that the effect of electromagnetic radiation on fluid media can be explained by the phenomenon of resonant response of the system receiving the radiation. Studies were made on plant seeds and yeasts, accompanied by catalytic chemical reactions and several physical and chemical tests. Sorption of trypaflavine by seeds was studied with exposure of distilled water to laser radiation. It was found that the duration of preservation of acquired properties depends on wavelength. The shorter the wavelength, the greater the degree of attentuation of changes in the properties of the water, as reflected by trypaflavine sorption by seed cells. Similar results were obtained in a study of the dynamics of hemolysis of erythrocytes in a saline solution. Changes in biological and physicochemical activity in fluid media correlate with wavelength. Author

N87-28086# Joint Publications Research Service, Arlington, Va.
ASSESSMENT OF RATE OF EQUATORIAL UPWELLING IN CENTRAL PACIFIC OCEAN Abstract Only **c48**
V. A. Bubnov *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 41 Transl. into ENGLISH from Okeanologiya (Moscow, USSR), v. 26, no. 4, Jul. - Aug. 1986 p 597-602 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

Results of calculations of the rate of equatorial upwelling in the Central Pacific Ocean, based on observations of currents conducted in February through March 1980, are presented and discussed. Calculations were carried out using a continuity equation on the basis of a box model for the area 1 deg 30' N to 1 deg 30' S, 163 deg 15' W to 167 deg W. Vertical movement in the upper 300 m layer is directed upward with changes in rate within limits of (1.0 to 8.0) x 10(-3) cm/s. Divergences of meridional currents play a large role in formation of features of vertical movement near the equator. Author

N87-28087# Joint Publications Research Service, Arlington, Va.
PECULIARITIES OF PRESENT-DAY STRUCTURE OF SOUTHERN ANTILLES REGION (SOUTH ATLANTIC) Abstract Only **c48**
A. G. Ryabukhin *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 45-46 Transl. into ENGLISH from Byulleten Moskovskogo Obshchestva Ispytateley Prirody: Otdel Geologicheskiy (Moscow, USSR), v. 61, no. 5, Sep. - Oct. 1986 p 37-45 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

The Southern Antilles region is the least investigated link in the Pacific folded belt, its study having been inhibited by extremely severe climatic conditions and distance. Recent studies in the area are discussed. Many of the key elements of the palinspastic reconstruction of Gondwanaland in the Mesozoic and Cenozoic depend on interpretation of the structure and history of development of the region. The analysis of the contemporary structure of the region indicates the mosaic nature of the structure, containing blocks of various ages with various types of crustal structure. One peculiarity of the Southern Antilles region is the relative youth of the structures which form it. Formation of the region resulted from processes of destruction of the continental crust related to the splitting apart of South America and Antarctica 29 million years ago. Author

N87-28088# Joint Publications Research Service, Arlington, Va.
STRATIGRAPHIC ASPECT OF PALEOMAGNETIC STUDIES OF BOTTOM SEDIMENTS IN SEAS AND OCEANS Abstract ONly **c48**
A. N. Tretyak, L. I. Vigilyanskaya, and V. P. Dudkin *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 47 Transl. into ENGLISH from Geofizicheskiy Zhurnal (Kiev, USSR), v. 8, no. 5, Sep. - Oct. 1986 p 23-35 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

The possibility of applying the paleomagnetic method to the stratigraphy of bottom sediments in the ocean was examined. Paleomagnetic methods can be quite useful in the stratigraphy of sediments of the Pliocene-Pleistocene ocean bottom. The unreliability of time correlations of geomagnetic events and episodes has resulted in the development of two alternative concepts of the structure of very recent geomagnetic time. The characteristics of spatial changes of the geomagnetic field are also poorly known. A number of results published in the literature indicate the very complex nature of changes in the geomagnetic field over the past million years. Some results obtained by the authors in paleomagnetic-stratigraphic studies in the Indian and Atlantic Oceans are briefly discussed. Detailed study of the magnetization of these bottom sediments reveals a series of brief reversals of geomagnetic field polarity, strictly correlated in time. These events in the magnetic history of the Earth can serve as reference levels to be used in stratigraphic correlation of other materials from other areas. Deep marine deposits can yield good information for the development of paleomagnetic stratigraphy. Some deep-water sediments contain a complete or nearly complete record of the development of the terrestrial magnetic field over the past 3.5 million years. Author

N87-28089# Joint Publications Research Service, Arlington, Va.
SOLUTION OF DIRECT GRAVIMETRIC AND MAGNETOMETRIC PROBLEMS ON BASIS OF NEW ANALYTICAL REPRESENTATIONS FOR ELEMENTS OF FIELDS FROM STANDARD APPROXIMATING BODIES Abstract Only **c46**
V. N. Strakhov, M. I. Lapina, and A. B. Yefimov *In its* USSR

Report: Earth Sciences 4 Mar. 1987 p 60-61 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Zemli (Moscow, USSR), no. 7, Jul. 1986 p 66-78 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

Efficient algorithms for the solution of direct gravimetric and magnetometric problems were developed. Analytical expressions were derived for the elements of outer and inner gravity and magnetic fields from standard approximating homogeneous bodies: polygons for the two dimensional problem, and polygonal plates and polyhedrons for the three dimensional problem. In addition, the programs worked out for implementating the proposed approach are described. A number of special procedures were applied for increasing the accuracy and speed of the programs. A description is given of the auxiliary algorithms used in the complex, the general characteristics of the latter are outlined and the results of testing of these programs are given for a large number of model examples. Author

N87-28090# Joint Publications Research Service, Arlington, Va.
PROSPECTS FOR DEVELOPING GRAVITATIONAL GRADIOMETER FOR MOVING BASE Abstract Only **c46**
I. I. Kalinnikov *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 61 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Zemli (Moscow, USSR), no. 7, Jul. 1986 p 105-111 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

Gravitational gradiometers suffer from the following deficiencies: unwieldiness, long time required for measurements at stations, low resolution for many classes of objects, rigorous requirements on measurement conditions, and need for rigorous allowance for relief in the near zone. The difficulties involved in overcoming these technical limitations and in providing an instrument operable on a moving base are discussed. It is concluded that no detailed evaluations of the prospects for developing such a gravitational gradiometer can be made until after derivation of a new Einstein formula for Brownian motion in gravi-inertial instruments. Since the main source of noise in accelerometers, gravimeters and gradiometers is gravi-inertial disturbances, not thermal noise, the use of cryogenic methods for increasing response cannot provide any increase in gradient measuring accuracy. It is further concluded that if a gradiometer in a phase-frequency variant on a moving base cannot be developed, it cannot be created at all. Author

N87-28091# Joint Publications Research Service, Arlington, Va.
MECHANISM OF FORMATION OF EARTH'S CONTINENTAL CRUST Abstract Only **c46**
O. A. Bogatikov and A. A. Tsvetkov *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 64 Transl. into ENGLISH from Vestnik Akademii Nauk SSSR (Moscow, USSR), no. 6, Jun. 1986 p 71-82 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

Augmentation of the continents occurs at the expense of the transition zone from the ocean to the continent. Continental growth occurs due to the successive adding-on of volcanic zones. Much research is being done on formation of the continental crust as a result of magmatic activity in transition zones from the ocean to the continent. It is now clear that there is a definite relationship between continental growth and processes transpiring in island arcs. Present-day magma formation to a high degree is associated with these island arcs. The genesis and evolution of island arcs is attributable to processes transpiring in seismofocal zones. There is a continuity in island arc evolution and it is possible to distinguish three types of present-day arcs: young, well developed and mature. The traces of ancient island arcs can be detected within folded zones on the continents. The continental crust therefore matures from the oceanic crust as a result of a long and complex process of evolution of island arcs from young to mature. It is stressed that the duration of development of arcs may differ considerably, attributable to the fact that in individual arcs the duration of periods of tholeiitic, calcareous-alkaline and other rarer types of magmatism is considerably different. Author

N87-28092# Joint Publications Research Service, Arlington, Va.
USSR REPORT: EARTH SCIENCES
9 Jul. 1987 117 p Transl. into ENGLISH from various Russian articles
(JPRS-UES-87-005) Avail: NTIS HC A06/MF A01

Translations of journal articles and books published in the U.S.S.R. are presented, which concern themselves with the earth sciences. The subject areas emphasized are: meteorology, oceanography, terrestrial geophysics, physics of the atmosphere and arctic and antarctic research. For individual titles, see N87-28093 through N87-28107.

N87-28093# Joint Publications Research Service, Arlington, Va.
THE GLOBAL MECHANISM OF STORMS Abstract Only **c47**
In its USSR Report: Earth Sciences 9 Jul. 1987 p 1 Transl. into ENGLISH from Tass (Leningrad, USSR), 27 Dec. 1986 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

Soviet geophysicists have established the electrical capacity of the giant natural spherical condenser, which happens to be the Earth. They have calculated that the difference of potentials between the positively charged ionosphere and the negatively charged rock surface measures 250 to 300 thousand volts. This charge could be neutralized in a matter of minutes if the losses were not constantly replaced due to the storm activities of the clouds. This conclusion was reached after conducting experiments on a computer with a mathematical model of global storm conditions. It was calculated that each second 1,800 storms rage simultaneously above the Earth, with the total current of 900 A. It was possible to tell that their maximum activity falls in the time period from 1800 to 1900 gmt, but the flashes of lightening illuminate the globe least frequently from 0300 to 0400. This study helps to solve such problems as the improvement of wireless communication, transmission of electrical power over long distances and other. Author

N87-28094# Joint Publications Research Service, Arlington, Va.
WHAT CLIMATE IS TYPICAL FOR THE EARTH Abstract Only **c47**
N. M. Chumakov *In its* USSR Report: Earth Sciences 9 Jul. 1987 p 2 Transl. into ENGLISH from Priroda (Moscow, USSR), no. 10, Oct. 1986 p 34-45 Original language document was announced in IAA as A87-29178 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

An effort is made to determine what climatic zonality has been typical for the Earth in past ages. Climate is examined in relation to the location of the continents, and two extreme types of climatic zonality (warm and cold) are proposed. It is concluded that the climatic zonality that now exists on Earth is not all that typical; it appears that a warm climate has been more typical in past ages. Author

N87-28095# Joint Publications Research Service, Arlington, Va.
NATURAL AND ANTHROPOGENIC CLIMATIC CHANGES Abstract Only **c47**
K. Ya. Kondratyev *In its* USSR Report: Earth Sciences 9 Jul. 1987 p 2 Transl. into ENGLISH from Vestnik Akademii Nauk SSSR (Moscow, USSR), no. 10, Oct. 1986 p 30-39 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

The level of knowledge concerning natural and anthropogenic climatic changes are summarized. The full range of physical factors involved in the formation of climate and its changes are covered, including the need for further development of the theory of climate and clarification of its contribution to study of current changes, both natural and anthropogenic, and the necessity of anthropogenic factors to be taken into account in climatic predictions Author

N87-28096# Joint Publications Research Service, Arlington, Va.
SEMINAR ON MATHEMATICAL MODELING OF GEOPHYSICAL CURRENTS Abstract Only **c46**
V. A. Ryabchenko *In its* USSR Report: Earth Sciences 9 Jul.

1987 p 11 Transl. into ENGLISH from Okeanologiya (Moscow, USSR), v. 26, no. 6, Nov. - Dec. 1986 p 1040-1044 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

The purpose of the seminar was to exchange ideas and experience in the field of mathematical modeling of geophysical phenomena, including processes occurring in the ocean, atmosphere, cryosphere and upper mantle. The theme of the seminar includes modeling of turbulent currents in the boundary layers of the atmosphere and ocean, circulation of the ocean and atmosphere, tidal movement in the ocean and crust, storm surges and floods, as well as methods of computational mathematics.
Author

N87-28097# Joint Publications Research Service, Arlington, Va.
MODELING OF SYNOPTIC VARIABILITY OF LARGE-SCALE OCEAN CIRCULATION (EXEMPLIFIED BY NORTH ATLANTIC) Abstract Only **c48**
D. G. Seidov, A. D. Marushkevich, and D. A. Nechayev *In its* USSR Report: Earth Sciences 9 Jul. 1987 p 18-19 Transl. into ENGLISH from Okeanologiya (Moscow, USSR), v. 26, no. 6, Nov. - Dec. 1986 p 885-891 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

In a series of eddy resolving experiments, two grids were used to calculate the evolution of hydrophysical fields: One was for computing integral eddies, the other, coarser grid, for computing temperature field evolution. Water density was assumed to vary only with temperature. A series of diagnostic and prognostic experiments was performed. The effects found in the diagnostic calculations were seen more strongly in the prognostic experiments in which a relationship existed between the baroclinic and borotropic modes of motion. The calculations confirmed that synoptic eddies are maintained by the effect of negative viscosity of the gradient of large scale hydrophysical fields. The major zone of circulation is the frontal zone of the Gulf Stream. Author

N87-28098# Joint Publications Research Service, Arlington, Va.
MEASURING PROBABILISTIC DISTRIBUTION OF SEA SURFACE CURVATURE RADII Abstract Only **c48**
I. B. Yesipov, K. A. Naugolnykh, V. N. Nosov, and S. Yu. Pashin *In its* USSR Report: Earth Sciences 9 Jul. 1987 p 27 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Atmosfery i Okeana (Moscow, USSR), v. 22, no. 10, Oct. 1986 p 1115-1117 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

An experiment was carried out both in the laboratory and in situ of the probabilistic distribution of curvature radii of a water surface as a function of wind speed. The optical measurement method described by J. Wu was used. Optical sounding of the wave-covered water surface was by a thin light ray with a circular cross section. The intensity of an individual light pulse registered by a photodetector upon reflection of the light beam from a mirror point is unambiguously related to surface curvature at the reflection point, making it possible to determine curvature radius. The experiment indicated that it is not only possible to make remote measurements of the radius of curvature of the wave covered water surface, but also to register the variability of the radii of curvature of the surface waves with a change in wind speed, surface currents and displacement of the thermocline. E.R.

N87-28099# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF AEROSOL EXTINCTION AND VARIATIONS OF METEOROLOGICAL PARAMETERS ON ACCURACY IN DETERMINING OCEAN SURFACE TEMPERATURE Abstract Only **c48**
S. V. Afonin, A. G. Gendrin, and V. V. Fomin *In its* USSR Report: Earth Sciences 9 Jul. 1987 p 28 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Atmosfery i Okeana (Moscow, USSR), v. 22, no. 10, Oct. 1986 p 1109-1112 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

The problem of determining ocean surface temperature was solved by a method involving the numerical modeling of the mechanisms of extinction and transfer of radiation in the atmosphere. The radiation model used is described. It is concluded that the neglecting of aerosol extinction, even in a slightly turbid atmosphere, in the case of high values of the coefficient of molecular extinction, may result in substantial errors in determining ocean surface temperature and does not make it possible to achieve an accuracy of + or - 1 K. Author

N87-28100# Joint Publications Research Service, Arlington, Va.
RADIATION REGIME OF GULF STREAM ENERGY ACTIVE REGION DURING WINTER Abstract Only **c48**
L. I. Koprova *In its* USSR Report: Earth Sciences 9 Jul. 1987 p 30 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Atmosfery i Okeana (Moscow, USSR), v. 22, no. 10, Oct. 1986 p 1082-1088 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

The radiation regime of the Gulf Stream energy active region was studied from January to March 1984 in the area 35 to 41 deg N, 60 to 65 deg W, an area whose radiation regime has been poorly studied because it is characterized by severe storms which are unfavorable for actinometric measurements. During the light hours of day, continuous measurements were made of total and reflected solar radiation and hourly measurements of direct solar radiation on perpendicular and horizontal surfaces. Scattered radiation, the long wave balance, and the total radiation balance were computed using hourly meteorological observations and measurement of the radiation temperature of the ocean surface made using an IR radiometer. Discussed in detail is the statistical characteristics of radiation fluxes, influence of cloud cover on radiation, variability of ocean surface albedo and atmospheric transparency. Author

N87-28101# Joint Publications Research Service, Arlington, Va.
EDDY DYNAMICS AND SOUTHERN HEMISPHERE ATMOSPHERIC ENERGETICS AT CLIMATIC SCALES Abstract Only **c47**
V. F. Romanov and V. Ye. Lagun *In its* USSR Report: Earth Sciences 9 Jul. 1987 p 36-37 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 291, no. 4, Dec. 1986 p 817-822 Original language document was announced in IAA as A87-29044 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

With several factors which determine the formation of weather and climatic conditions taken into account, the mechanisms of formation of anomalies with active energy exchange during time scale periods are clarified, attributing it to the influence of the synoptic eddies concentration which stimulate energy exchange. This is done with emphasis on the Southern Hemisphere, where such processes have been poorly studied. The climatic eddies, forming in climatic fields in regions of high concentration of synoptic eddies, are investigated, especially the parameters of their energetics. It is shown that these parameters are consistent with the energy regime of the synoptic eddies. There is a two phase character of the dynamics of atmospheric movements at the synoptic spatial and time scales. Author

N87-28102# Joint Publications Research Service, Arlington, Va.
DISCOVERY OF HELIUM THE SAME AGE AS THE PLANET CONTRIBUTES TO VOLCANOLOGY Abstract Only **c46**
In its USSR Report: Earth Sciences 9 Jul. 1987 p 39 Transl. into ENGLISH from Tass (Leningrad, USSR), 20 Dec. 1986 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

Some Soviet physicists created a new instrument capable of discovering and quantifying even atoms of substances in samples of rocks, water and air. Using this to seek light helium led to the discovery of a very rare natural phenomenon: it turned out that the depths of the planet contain thousands of times more of it than the crust. This discovery has formed the basis of a new

science, the isotope geochemistry of helium, which is now being widely used in various spheres of the Earth sciences. Thus, the content of light helium can be used to forecast volcanic eruptions; if the thermal waters of the slopes of volcanoes register an increased content of helium-3, that means that large masses of hot magma have risen from the depths of the seat of the volcano. Author

N87-28103# Joint Publications Research Service, Arlington, Va.
SEISMIC FOCUS IS KEY TO SEISMIC DANGER PROBLEM **c46**
Nikolai Shebalin *In its* USSR Report: Earth Sciences 9 Jul. 1987 p 42-45 Transl. into ENGLISH from Novosti Nauki i Tekhniki (Moscow, USSR), no. 15, 3 Oct. 1986 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

Earthquakes continue to be a terrible threat to humankind. Scientists often fail to predict them and protection against them is often ineffective. The reason for this is the inadequate knowledge of the formation and operation of sources of disastrous tremors known as seismic foci. How seismic foci can be used to forecast earthquakes is discussed along with different methods to study them. Author

N87-28104# Joint Publications Research Service, Arlington, Va.
FORECASTERS OF EARTHQUAKES **c46**
Lyudmila Maximova *In its* USSR Report: Earth Sciences 9 Jul. 1987 p 53-55 Transl. into ENGLISH from Novosti Nauki i Tekhniki (Moscow, USSR), no. 23(106), 5 Dec. 1986 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

For the first time Soviet scientists have set up a bioseismological proving ground which will stage a systematic extensive experiment of using birds, ants, mountain rodents including marmots, which can dig holes in the Earth's interior to a depth of 50 meters, for the purpose of earthquake forecasting. Biologists have accumulated extensive experimental data on the impact of various electromagnetic fields, including fields of weak intensity, on living organisms. As far as mammals are concerned, electromagnetic waves with frequencies close to the brain's biorhythms have the strongest effect. How these observations can be used to forecast earthquakes is discussed. Author

N87-28105# Joint Publications Research Service, Arlington, Va.
SOLITON PROPERTIES OF TELESEISMIC WAVES Abstract Only **c46**
N. G. Gamburtseva, A. V. Nikolayev, O. B. Khavroshkin, and V. V. Tsyplakov *In its* USSR Report: Earth Sciences 9 Jul. 1987 p 85 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 291, no. 4, Dec. 1986 p 814-816 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

The first arrivals of teleseismic P-waves were analyzed (their amplitude at the source was determined by source intensity). The travel times of the first longitudinal wave from powerful shots, whose intensity varied by 1.5 to 2 orders of magnitude, were measured. Depending on source intensity the shock wave lifetime varied, but its contribution to the change in travel time was far beyond instrument resolution. Registry stations were situated at epicentral distances 200, 600, and 3,000 km. The signal-to-noise ratio for minimum shot intensities at a distance 3,000 km always exceeded 3; in no case was the first phase omitted. The analysis revealed soliton properties of these teleseismic waves, properties which can be explained by several physical models. Author

N87-28106# Joint Publications Research Service, Arlington, Va.
DETERMINING ATMOSPHERIC TEMPERATURE AND PRESSURE PROFILES FROM MEASUREMENTS OF ASTRONOMICAL REFRACTION NEAR HORIZON Abstract Only **c46**
N. A. Vasilenko, K. P. Gaykovich, and M. I. Sumin *In its* USSR Report: Earth Sciences 9 Jul. 1987 p 98 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Atmosfery i Okeana (Moscow, USSR), v. 22, no. 10, Oct. 1986 p 1026-1033 Original language document was announced in IAA as A87-25190 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

The results of retrieval of the vertical profiles of atmospheric parameters are given on the basis of measurements of the optical refraction of celestial bodies from the Earth's surface at positive angles of elevation. The study is based on the results of simultaneous astronomical and aerological observations made in October 1968 and 1972. The measurement region was a slightly hilly semi-desert with a clayey-rocky underlying surface. The retrieval was based on solution of the corresponding inverse problem relative to the refractive index. The accuracy of retrieval is comparable to the best theoretical evaluations of the accuracy of retrieval by the surface microwave radiometry method. Author

N87-28107# Joint Publications Research Service, Arlington, Va.
OZONE HOLE OVER THE ANTARCTIC Abstract Only **c46**
In its USSR Report: Earth Sciences 9 Jul. 1987 p 100 Transl. into ENGLISH from Tass (Moscow, USSR), 23 Jan. 1987 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

The ozone hole over the Antarctic has an undoubted influence on climate and weather in the world. Absorbing solar radiation, ozone causes air heating in the stratosphere. Such heat processes are upset in the hole, and atmospheric circulation is changing; hence, instability of climate and winds. Weathermen in the future will surely take this phenomenon into account. Ozone concentration changes seasonally and latitudinally, increasing from winter to summertime and during warm times, from equator to the poles. Though the hole occupies a relatively large area, over one million square kilometers, it appears only in October. Author

43 EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N87-28108 Ohio State Univ., Columbus.
THE ALTIMETRY-GRAVIMETRY PROBLEM USING ORTHONORMAL BASE FUNCTIONS Ph.D. Thesis
Andre Mainville 1987 214 p
Avail: Univ. Microfilms Order No. DA8710024

This study was undertaken to find a numerical solution of a mixed boundary value problem on a spherical Earth. The problem is that of altimetry-gravimetry which is defined from gravity anomalies determined by gravimeter measurements mostly on continents and from geoid undulations known on the oceans from the methods of satellite altimetry. The result of the solution of the altimetry-gravimetry problem is a set of coefficients of the new orthonormal base functions. These coefficients were retransformed into the ones of the usual spherical harmonics expansion. The spherical harmonics coefficients can then easily be analyzed and compared with existing Earth gravity field expansions. The method is a least squares method. Dissert. Abstr.

N87-28109# Du Pont de Nemours (E. I.) and Co., Aiken, S.C.
COLOR INFRARED VIDEO MAPPING OF UPLAND AND WETLAND COMMUNITIES
H. E. Mackey, Jr., J. R. Jensen, M. E. Hodgson, and K. W. OCuilinn 1987 15 p Presented at the 11th Biennial Workshop on Color Aerial Photography in the Plant Sciences, Weslaco, Tex., 27 Apr. 1987 Prepared in cooperation with South Carolina Univ., Columbia and Coyote (E.) Enterprises, Inc., Mineral Wells, Tex.
(Contract DE-AC09-76SR-00001)
(DE87-010202; DP-MS-86-210; CONF-8704136-1) Avail: NTIS HC A02/MF A01

Color infrared images were obtained using a video remote sensing system at 3000 and 5000 feet over a variety of terrestrial

and wetland sites on the Savannah River Plant near Aiken, SC. The terrestrial sites ranged from secondary successional old field areas to even aged pine stands treated with varying levels of sewage sludge. The wetland sites ranged from marsh and macrophyte areas to mature cypress-tupelo swamp forests. The video data were collected in three spectral channels, 0.5-0.6 microns, 0.6-0.7 microns, and 0.7-1.1 microns at a 12.5 mm focal length. The data were converted to digital form and processed with standard techniques. Comparisons of the video images were made with aircraft multispectral scanner (MSS) data collected previously from the same sites. The analyses of the video data indicated that this technique may present a low cost alternative for evaluation of vegetation and landcover types for environmental monitoring and assessment. DOE

N87-28110# Technische Hogeschool, Delft (Netherlands). Dept. of Geodesy.
SIMULATION AND ADJUSTMENT OF 3D NETWORKS IN THE CONCEPT OF INTEGRATED GEODESY
A. D. Bottse Aug. 1986 76 p
(B8681155; ETN-87-90173) Avail: NTIS HC A05/MF A01

The principles of integrated geodesy are outlined, and the simulation program AREPO is described. The integrated concept is used to determine 3D coordinates of points on Earth and the Earth's gravity field, from a combined adjustment of heterogeneous data. Least squares collocation with parameters is used to solve for the required unknowns. The adjustment of observations simulated by AREPO shows that the collocation method produces good solutions. ESA

N87-28111*# Kansas State Univ., Manhattan. Evapotranspiration Lab.
ASSESSMENT OF THE BIOPHYSICAL CHARACTERISTICS OF RANGELAND COMMUNITY USING SCATTEROMETER AND OPTICAL MEASUREMENTS Final Report
E. T. Kanemasu, Ghassem Asrar, Ranga Myneni, Robert Martin, Jr., and R. Bruce Burnett 1 Aug. 1987 99 p
(Grant NAG9-156)
(NASA-CR-181282; NAS 1.26:181282) Avail: NTIS HC A05/MF A01 CSCL 08H

Research activities for the following study areas are summarized: single scattering of parallel direct and axially symmetric diffuse solar radiation in vegetative canopies; the use of successive orders of scattering approximations (SOSA) for treating multiple scattering in a plant canopy; reflectance of a soybean canopy using the SOSA method; and C-band scatterometer measurements of the Konza tallgrass prairie. Author

N87-28112# National Aerospace Lab., Amsterdam (Netherlands). Space Div.
CCD AIRBORNE EXPRIMENTAL SCANNER FOR APPLICATIONS IN REMOTE SENSING (CAESAR)
N. J. J. Bunnik, H. Pouwels, C. Smorenburg, and A. L. G. vanValkenburg 23 Apr. 1986 8 p Presented at the International Symposium on Remote Sensing (ISPRS), Enschede, The Netherlands, 25-29 Aug. 1986
(NLR-MP-86029-U; B8701677; ETN-87-90187) Avail: NTIS HC A02/MF A01

An airborne multispectral scanner based on CCD detectors was developed and tested to obtain technical experience with the electro-optical properties of commercially available CCD's and to provide a versatile system to be used in experimental remote sensing. A modular design consisting of 4 three-channel CCD cameras was chosen. By means of exchangeable filters different configurations for land and sea observation are available. Several selections can be made for along track integration time, swath width, and radiometric resolution. Flight velocity and aircraft attitude are registered together with digital image data. Preflight relative and absolute calibrations for each detector element were performed. By means of a dark current correction, calibration, and aircraft attitude data, system geometric and radiometric corrections are applied prior to digital analysis. Results of flights over land and sea are presented. ESA

N87-28113# National Aerospace Lab., Amsterdam (Netherlands). Space Div.
THE DETERMINATION OF OPTIMUM PARAMETERS FOR IDENTIFICATION OF AGRICULTURAL CROPS WITH AIRBORNE SLAR DATA
P. Binnenkade 5 May 1986 8 p Presented at the International Symposium on Remote Sensing (ISPRS), Enschede, The Netherlands, 25-29 Aug. 1986
(NLR-MP-86033-U; B8701680; ETN-87-90189) Avail: NTIS HC A02/MF A01

Side-looking airborne radar campaigns for crop identification are described. From data-acquisition through classification the determining parameters are elaborated. A campaign which used steeper incidence angles in order to simulate satellite data is discussed. Classification results were compared to the ground truth map of a test site, showing that small grazing angles result in excellent discrimination capabilities between various crop types especially potatoes. The accuracy obtained exceeds 90% for most test sites. However, with the advent of satellite systems that carry microwave sensors for land applications, airborne (semi-)operational programs will become largely obsolete due to the multitemporal and the synoptic characteristics of spaceborne systems. ESA

N87-28114*# Ohio State Univ., Columbus. Dept. of Geodetic Science and Surveying.
GEOID UNDULATION COMPUTATIONS AT LASER TRACKING STATIONS
Vasilios K. Despotakis Sep. 1987 144 p
(Grant NGR-36-008-161)
(NASA-CR-181298; NAS 1.26:181298; Rept-383) Avail: NTIS HC A07/MF A01 CSCL 08E

Geoid undulation computations were performed at 29 laser stations distributed around the world using a combination of terrestrial gravity data within a cap of radius 2 deg and a potential coefficient set up to 180 deg. The traditional methods of Stokes' and Meissl's modification together with the Molodenskii method and the modified Sjoberg method were applied. Performing numerical tests based on global error assumptions regarding the terrestrial data and the geopotential set it was concluded that the modified Sjoberg method is the most accurate and promising technique for geoid undulation computations. The numerical computations for the geoid undulations using all the four methods resulted in agreement with the ellipsoidal minus orthometric value of the undulations on the order of 60 cm or better for most of the laser stations in the eastern United States, Australia, Japan, Bermuda, and Europe. A systematic discrepancy of about 2 meters for most of the western United States stations was detected and verified by using two relatively independent data sets. For oceanic laser stations in the western Atlantic and Pacific oceans that have no terrestrial data available, the adjusted GEOS-3 and SEASAT altimeter data were used for the computation of the geoid undulation in a collocation method. Author

N87-28115# European Space Agency, Paris (France).
PROCEEDINGS OF THE ESA-EARSEL EUROPE FROM SPACE SYMPOSIUM
Olga Melita, comp. Dec. 1986 325 p Symposium held in Lyngby, Denmark, 25-27 Jun. 1986
(ESA-SP-258; ISSN-0379-6566; ETN-87-90155) Copyright Avail: NTIS HC A14/MF A01

Spaceborne remote sensing for cartography and geoinformation; environmental monitoring; economic factors in satellite remote sensing; inventory and monitoring of renewable resources; and disaster management were discussed. For individual titles, see N87-28116 through N87-28158.

N87-28116# Copenhagen Univ. (Denmark). Inst. of Geography.
CONTRIBUTION OF SECOND GENERATION EARTH OBSERVATION SATELLITE (SGEOS) DATA TO A DANISH LAND INFORMATION AND CROP MONITORING SYSTEM
Kjeld Rasmussen and Thomas Balstroem *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 3-8 Sponsored by the Danish Ministry of Agriculture Bureau of Land Data, and the Society of Nordic Forest Research (For primary document see N87-28115 22-43)
Copyright Avail: NTIS HC A14/MF A01

A satellite land use mapping and monitoring project, emphasizing forests is presented. The overall idea, the proposed data flow, and experimental results are demonstrated, as well as results from a pilot study based on multitemporal LANDSAT data. Problems of integrating satellite remote sensing data and conventional vector-oriented geographical information systems are discussed. ESA

N87-28117# Technische Univ., Munich (West Germany). Lehrstuhl fuer Geographie und Geogr. Fernerkundung.
URBAN DEVELOPMENT PLANNING USING THEMATIC MAPPER DATA OF MUNICH (FRG)
F.-W. Strathmann and H. Kaufmann (Karlsruhe Univ., West Germany) *In* ESA Proceedings of the ESA-EARSeL Europe from Space Symposium Dec. 1986 p 9-14 (For primary document see N87-28115 22-43)
Copyright Avail: NTIS HC A14/MF A01

With regard to the requirements of thematic mapping and development planning in urban areas, multitemporal datasets of LANDSAT Thematic Mapper (TM) were investigated to demonstrate the possibilities and limitations of high resolution satellite imagery. An image improvement concept, based on combined filtering and color-coding algorithms was developed. It guarantees an optimized presentation of structural and spectral image contents. A catalog of band combinations for the enhancement of different land use categories and urban details was elaborated. Results of the image analysis provide information about basic building features and typical land use patterns. Because the multitemporal use offers an actual data base for change detection in urban areas, TM mapping and monitoring can be useful for the extension of urban/regional information systems. For needs of urban development planning TM data can only have a supplementary function. ESA

N87-28118# Politecnico di Milano (Italy).
LARGE FORMAT CAMERA: THE SECOND GENERATION PHOTOGRAMMETRIC CAMERA FOR SPACE CARTOGRAPHY **c35**
G. Togliatti and A. Moriondo *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 15-18 (For primary document see N87-28115 22-43)
Copyright Avail: NTIS HC A14/MF A01

The shuttle-borne Large Format Camera (LFC) gave high quality photogrammetric images due to three mechanical features: image motion compensator, stellar cameras, and reseau. Images were tested to evaluate their semantic contents, the plano-altimetric accuracy of the stereomodels, and usefulness for map revision and for new line maps and orthophotos. The contents of the LFC images is exceptionally high, far more than in any 1:50,000 map. The identification of details depends more on contrast with background than on size. The mean square error in planimetric measures is 5 m, in elevation it is 5 to 7 m, according to procedures. The photomaps and orthophotomaps derived from LFC stereomodels are very good and preserve the high level of information. ESA

N87-28119# Technische Univ., Munich (West Germany). Inst. for General and Applied Geology.
INTEGRATION OF REMOTE SENSING AND GEOPHYSICAL DATA-APPLICATION TO EXPLORATION OF PYRITE ORE FACIES IN SW SPAIN
P. Volk *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 21-27 (For primary document see N87-28115 22-43)
(Contract BMFT-01-QS-0730)
Copyright Avail: NTIS HC A14/MF A01

Information contents of remote sensing and geophysical data sets were assessed for mineral exploration. Aerial photographs and LANDSAT Thematic Mapper data provide a good basis for interpretation-optimized data-combination via an IHS, SST and HLF-Add approach. Two groups of thematic information were extracted: nondirect hints to ore facies (volcanogenic strata under sterile shallow cover); and direct hints to ore facies (anomalies related to physical properties of the ore itself). A field check and data about known mineralizations compared to the results obtained show good correlation. ESA

N87-28120# Institut fuer Allgemeine und Angewandte Geophysik, Munich (West Germany).
REQUIREMENTS ON RADAR DATA FOR GEOLOGICAL APPLICATION: A CASE STUDY BY USE OF MULTISTAGE DATA OF THE TESTSITE SARDEGNA/ITALY **c46**
F. Jaskolla and M. Rast (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands) *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 29-34 (For primary document see N87-28115 22-43)
Copyright Avail: NTIS HC A14/MF A01

Multitemporal LANDSAT MSS, Seasat-SAR, and multilook SIR-A and results from field investigations were used to assess the possibilities of radar geology in a Mediterranean site. Results show that radar data is very useful to support geological mapping purposes if it is correlated with other data sources. Structural investigations are limited due to geometric distortions. It is an absolute necessity to apply radargrammetric procedures; by doing this, the restricting factors due to radar geometry can be improved. Optimized results can be obtained by combining corrected radar data digitally with other information sources, e.g., LANDSAT MSS or TM. ESA

N87-28121# Geological Survey of the Netherlands, Enschede.
SPOT: HOW GOOD FOR GEOLOGY? A COMPARISON WITH LANDSAT MSS **c46**
A. Sesoeren *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 35-39 (For primary document see N87-28115 22-43)
Copyright Avail: NTIS HC A14/MF A01

Geological interpretation possibilities of SPOT MSS and LANDSAT MSS positive prints enlarged to the same scale were compared, using as a test area part of the Jebel Amour (Algeria). The SPOT imagery offers many advantages, filling the gap between remote sensing from space and aerial photography. The best results by visual interpretation are obtained in combining SPOT for the required details with LANDSAT for the synoptic veiw. Further improvements are expected from the use of SPOT stereo-pairs. ESA

N87-28122# European Space Agency. European Space Operations Center, Darmstadt (West Germany).
METEOROLOGICAL MONITORING WITH METEOSAT **c47**
J. Schmetz and O. Turpeinen *In its* Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 43-48 (For primary document see N87-28115 22-43)
Copyright Avail: NTIS HC A14/MF A01

Improvements to the extraction of cloud-track winds and an atmospheric correction scheme for Meteosat are discussed. A precipitation index is described. ESA

N87-28123# Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.
MONITORING OF SNOW COVER FROM SATELLITE
Martti Hallikainen, Petri Jolma, Martti Tiuri, and Risto Kuittinen (Technical Research Centre of Finland, Espoo.) *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 49-52 (For primary document see N87-28115 22-43)
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22-43)
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Monitoring of snow cover using spaceborne microwave radiometers is examined. Discrimination of snow-covered terrain (dry/wet snow) from snowfree terrain is discussed. Retrieval of the water equivalent of snow cover is based on the decrease of the brightness temperature with increasing snow depth, which is due to volume scattering of microwave emission by dry snow particles. For wet snow conditions, the brightness temperature is practically independent of snow depth. Retrieval accuracy is affected by short-term and annual variations in the properties of the topmost snow layers and by land-cover categories. ESA

N87-28124# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
CLOUD DETECTION IN NOAA IMAGES c47
John Skelmose Jensen *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 53-57 Sponsored by the Commission for Scientific Research in Greenland, and the Danish Space Reseach Committee (For primary document see N87-28115 22-43)
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A technique for cloud detection in NOAA satellite images is described. It operates with only one infrared channel (Ch 4) of NOAA AVHRR data and it is composed of two parts: a segmentation of the image into uniform areas and a classification of these uniform areas into water, ice, and clouds. The technique was evaluated over a test area of the East Greenland coast, and the detection of clouds over water gives good results. But the technique fails to distinguish between ice and clouds. ESA

N87-28125# Dundee Univ. (Scotland). Physics Lab.
SEA SURFACE TEMPERATURES AND THE DETECTION OF OCEAN CIRCULATION PATTERNS AND FRONTS FROM AVHRR IMAGERY c48
R. A. Vaughan, I. D. Downey (Salford Univ., England), D. Leng, and J. Coker *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 59-67 (For primary document see N87-28115 22-43)
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Data from the NOAA-8 AVHRR were used to study sea surface temperatures in the North East Atlantic and around the Eastern coast of Scotland. Using in situ temperature data, multichannel sea surface temperature algorithms were tested for their validity in these waters with varying degrees of success, and possible sources of error were considered. The development of circulation patterns in the waters in these areas was examined in relation to data from drifting buoys, and the stability of thermal fronts in the Irish and Celtic Seas was investigated. Cloud cover limits the usefulness of the technique. ESA

N87-28126# Institut National de la Recherche Agronomique, Montfavet (France). Station of Bioclimatologie.
ON THE USE OF NOAA-AVHRR DATA IN THE LOWER RHONE VALLEY (FRANCE) c47
J. P. Lagouarde, S. Clinet, S. Gandia, S. Roy, B. Seguin, A. Vidal, and Y. Kerr (Centre National d'Etudes Spatiales, Toulouse, France) *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 69-74 (For primary document see N87-28115 22-43)
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The NOAA-AVHRR derived normalized vegetation index (NDVI) and surface temperature are analyzed in the lower Rhone valley. The study of temporal evolution of NDVI during 1983 and 1984 on different types of vegetation at a regional (50 to 100 sq km) and more local scale (1 to 4 pixels) shows the potential of the data for vegetation monitoring. Atmosphere effects may cause large fluctuations of NDVI values: a correction is proposed for water while the effect of aerosols is also analyzed. For surface temperature, a calibration against ground measurements is presented: satellite data appear underestimated by 3 to 4 C. Use of NOAA data with an agrometeorological model is described and examples of applications given: estimation of regional evapotranspiration, determination of useful water soil reserve, and irrigation supplied to crops. ESA

N87-28127# Joint Research Centre of the European Communities, Ispra (Italy). Remote Sensing Div.
RURAL LAND USE INVENTORY AND MAPPING IN THE ARDECHE AREA (FRANCE). IMPROVEMENT OF AUTOMATIC CLASSIFICATION BY MULTITEMPORAL ANALYSIS OF TM DATA
Joachim Hill and Jacques Megier *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 75-85 (For primary document see N87-28115 22-43)
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A set of four Thematic Mapper scenes (LANDSAT-5) was examined. The images can be rectified to map projection with excellent accuracy, but superposition of four TM subframes is affected by relief induced distortions and residual rotations. A systematic compensation of the relief dependent dislocations is not possible due to the lack of a digital terrain model. Further image analysis included the generation of multitemporal normalized vegetation index, image enhancement by edge preserving smoothing, verification and refinement of ground truth information, and supervised classification (maximum likelihood). Best results are achieved when classification output from 2 different data sets (multitemporal vegetation index, multitemporal combination of TM 3, 4, and 5) are combined. ESA

N87-28128# Florence Univ. (Italy).
CROP DISCRIMINATION BY MEANS OF RADAR AND INFRARED IMAGES
G. Benelli, V. Cappellini, L. Nigro, S. Paloscia, and P. Pampaloni (Consiglio Nazionale delle Ricerche, Florence, Italy) *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 87-91 (For primary document see N87-28115 22-43)
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Filtering techniques, developed by Lee and Frost (1981, 1981) were used for noise reduction of X and C band images collected during the SAR 580 campaign. Using filtered images a crop classification on a pixel by pixel basis was carried out as an indirect test of two algorithms. Results show that the filters give almost the same performance, while crop classification is better pursued by using a Bayes classifier and multiband data. ESA

N87-28129# Ghent Univ. (Belgium). Lab. voor Regionale Geografie en Landschapskunde.
DETECTION OF SOIL DRAINAGE IN PAYS DE HERVE, BELGIUM, ON LANDSAT MSS IMAGERY
R. Goossens *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 93-99 (For primary document see N87-28115 22-43)
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The detection of soil drainage conditions in a grassland region, with different classes of soil drainage, using LANDSAT MSS images enhanced by using high gamma films is described. For the interpretation, the composite -4/-5 (enhanced) was used. Densitometric analysis shows a differentiation between well drained, poorly drained soils, and soils with perched water. Visual image analysis leads to photomorphic unit maps. The maps were compared with soil map and field data. A map of the soil drainage conditions was made. ESA

N87-28130# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CONTRIBUTION OF SPACE TECHNOLOGY TO DISASTER PREPAREDNESS, WARNING, AND RELIEF
L. Walter *In* ESA Proceedings of the ESA-EARSeL Europe from Space Symposium Dec. 1986 p 103-107 (For primary document see N87-28115 22-43)
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Use of remote sensing for disaster control and vulnerability analysis, disaster prevention, and disaster relief is discussed. ESA

N87-28131# Catania Univ. (Italy). Dept. of Engineering.
REMOTE SENSING INVESTIGATION OF THE OIL SPILL IN THE MESSINA STRAIT, ITALY **c45**
A. L. Geraci, G. LaRosa, and L. DelRe (Italian Navy, Spezia.) *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 109-114 (For primary document see N87-28115 22-43)
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The usefulness and applicability of remote sensing to oil spill control, in order to save money on the cleanup costs and to limit the damage to natural resources is demonstrated. Two tankers collided, spilling 1000 tons of oil near the Italian coast. Although boats and aircraft encountered problems in locating the slicks, experience gained in helicopter remote sensing for the control of marine pollution was refused by the authority in charge. So the investigation was carried out using infrared photography and LANDSAT MSS data only. The results indicate that if remote sensing techniques had been used on a regular basis the damage would have been less. ESA

N87-28132# Institute of Oceanographic Sciences, Wormley (England).
THE DETERMINATION OF SEA-STATE BIAS AND NON-LINEAR WAVE PARAMETERS FROM SATELLITE ALTIMETER DATA **c48**
T. H. Guymer and M. A. Srokosz *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 115-120 Sponsored in part by the UK ERS Data Center (For primary document see N87-28115 22-43)
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Data from the repeat track period of SEASAT were analyzed to investigate the variation of mesoscale ocean variability with sea state. Results show that the relationship is not constant but appears to depend on whether the wave field is developing or decaying. This is interpreted in terms of parameters describing the nonlinearities of the surface gravity waves. Implications for the interpretation of mesoscale variability analyses are discussed. Attempts to calculate the sea-state bias theoretically from the shape of the return pulse measured by an altimeter are described. ESA

N87-28133# Joint Research Centre of the European Communities, Ispra (Italy).
MONITORING AND MODELING OF THE ADRIATIC SEA **c48**
J. A. deBekkering *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 121-127 (For primary document see N87-28115 22-43)
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A program to develop a spaceborne monitoring system to track coastal transport of pollution is outlined. Sensors used include the Coastal Zone Color Scanner on NIMBUS 6, the Advanced Very High Resolution Radiometers on NOAA 6 and 9, and the LANDSAT 5 Thematic Mapper. A model of the northern Adriatic Sea was developed. Image processing, and measuring campaigns are described. ESA

N87-28134# Joint Research Centre of the European Communities, Ispra (Italy). Physics Div.
EVALUATION OF THE POTENTIAL OF THE THEMATIC MAPPER FOR MARINE APPLICATION
S. Tassan *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 129-136 (For primary document see N87-28115 22-43)
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The potential of the Thematic Mapper (TM) for chlorophyll and suspended sediment determination in the sea was investigated by comparison with the Coastal Zone Color Scanner (CZCS) on NIMBUS-7. A sensitivity analysis, considering error sources as retrieval algorithm sensitivity, atmospheric correction, instrument noise, and signal digitalization, was completed by a TM image analysis. Tests validate the positive conclusions of the theoretical work, indicating that the analysis of TM band 1 to 3 data can yield quantitative information on chlorophyll and sediment concentration in the sea of satisfactory quality, substantially similar to that of CZCS derived values. ESA

N87-28135# Dundee Univ. (Scotland). Physics Lab.
ON THE USE OF AVHRR CHANNEL-3 DATA FOR ENVIRONMENTAL STUDIES **c45**
A. P. Cracknell and M. C. Dobson *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 137-144 (For primary document see N87-28115 22-43)
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It is shown that NOAA AVHRR channel-3 data enable more discrimination to be achieved between different types of clouds than can be achieved with data from other channels. Channel-3 data can also be used, from night-time passes, in multichannel algorithms for calculating sea surface temperatures. The use of channel-3 data in monitoring gas flares at oil exploration and production platforms in the North Sea, and in monitoring agricultural straw burning is described. Results for Denmark are presented. ESA

N87-28136# Valencia Univ. (Spain). Dept. of Thermology.
THERMAL INFRARED IMAGES FROM SATELLITES COMPARED TO SHELTER TEMPERATURE. APPLICATION TO FROST NOWCASTING IN A CITRUS ORCHARD
V. Caselles, J. A. Sobrino, and J. Melia IN ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 145-150 Sponsored by the Comision Asesora para la Investigacion Cientifica y Tecnica (For primary document see N87-28115 22-43)
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The effective parameters of emissivity and temperature in a citrus orchard were determined and the significance of the shelter temperature measured among the trees was studied. The emissivity and temperature values of the different parts of the radiative system were calculated using a manual scanning system and the box method. During clear cloudless night without wind, when radiative frost may be produced, the effective values are almost identical to the orange tree ones. Air temperature significance depends on the atmospheric situation and the time, being more representative for clear cloudless nights without wind and less for the maximum heating period on clear days. ESA

N87-28137# Joint Research Centre of the European Communities, Ispra (Italy).
THE ROLE AND PERSPECTIVE OF REMOTE SENSING FOR DISASTER MANAGEMENT IN THE EUROPEAN COMMUNITY
S. R. GallideParatesi *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 151-162 (For primary document see N87-28115 22-43)
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A reconnaissance map derived from a representation matrix of the degree of application of a specific type of remote sensing system to a specific type of hazard/disaster for a specific type of management activity is described. Satellite options for disaster management application are discussed in terms of feasibility of the expected applications, timeliness and continuity of data delivery, reliability, and operation continuity of space platforms. It emerges that further priorities and allocation resources could be usefully applied to disaster management phases when supported by advanced space technologies. ESA

N87-28138# Technische Univ., Munich (West Germany). Lehrstuhl fuer Landschaftstechnik.
MONITORING AND INVENTORING OF FOREST DAMAGES BY USE OF LANDSAT TM DATA
B. Koch, R. Haydn, H. Kaufmann, and S. Krause-Rabe *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 163-168 (For primary document see N87-28115 22-43)
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Forest damage field investigations based on processed TM data, in which display ratios of near infrared against short wave infrared channels are described. To display subtle spectral

variations and to improve visual interpretation the Intensity Hue and Saturation approach was applied with ratio techniques. The results show that a differentiation of stands due to age classes is possible but the assessment of damage is not definite. ESA

N87-28139# Ruhr Univ., Bochum (West Germany).
SATELLITE REMOTE SENSING FOR WATER RESOURCES MANAGEMENT: SOME ENGINEERING AND ECONOMIC ASPECTS
Gert A. Schultz *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 171-177 (For primary document see N87-28115 22-43)
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The use of satellite imagery to identify changes of land use in a river catchment is described. If this information is entered into mathematical rainfall-runoff models, it is possible to show the effect of land use change on flood and low flow conditions quantitatively. A model which allows the determination of monthly river runoff values with the aid of satellite imagery is presented. It transforms temperature weighted cloud cover index values into runoff. Economic components influencing remote sensing applications are mentioned. ESA

N87-28140# Instituto Nacional de Investigaciones Agrarias, Madrid (Spain). Seccion de Proceso de Datos.
ERAFIS: A COMPUTER INFORMATION SYSTEM FOR AGRICULTURE AND FORESTRY IN SPAIN
J. M. Cuevas, F. Gonzalez-Alonso, and J. Moro *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 183-188 Sponsored by the Comision Asesora para la Investigacion Cientifica y Tecnica (For primary document see N87-28115 22-43)
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A system for processing remote sensing data and its integration with geographical and ecological data in an agricultural context was designed. The system is mainly oriented towards the recognition and superficial evaluation of crops using supervised classification techniques. The system was applied to an agricultural land use surface estimation study in the Toledo province (Spain) and the results demonstrate the viability of the adopted methodology to discriminate land uses. ESA

N87-28141# North East London Polytechnic, Dagenham (England). Dept. of Land Surveying.
ENVIRONMENTAL INFORMATION AND CARTOGRAPHY c45
Richard K. Bullard and Robert W. Dixon-Gough *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 189-194 (For primary document see N87-28115 22-43)
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Factors fundamental to the implementation of an environmental impact analysis investigation, in particular the acquisition of remotely sensed environmental data together with the means by which data can be brought together in a compatible format are discussed. Much of the data will be either raster or vector format and available in digital or analog form so the need to bring these sets of data together for their joint analysis is considered. The classification of data, its display, and reproduction to ensure that the best use is made of the analysis under consideration are looked at in respect of the environmental impact. ESA

N87-28142# Kingston Polytechnic, Kingston-Upon-Thames (England). School of Computing.
TOWARDS THE AUTOMATIC RECOGNITION AND VECTORISED DESCRIPTION OF LINEAR FEATURES IN LANDSAT TM IMAGES BY ARTIFICIAL INTELLIGENCE METHODS
G. Peacegood, G. G. Wilkinson, and P. F. Fisher *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 195-198 (For primary document see N87-28115 22-43)
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A method for extracting linear features in LANDSAT Thematic Mapper images, representing them, and improving the quality of the results is given. Low-level feature extraction involves: image convolution with 5 X 5 neighborhood masks in 6 directions; thresholding and thinning of the gradient image derived from each maximum value associated with a given direction; formation of arrays containing information about the location and direction of neighbors to edge points, limiting the maximum number to 4 (2 in front of, and 2 behind the edge point, where the terms in front of and behind are defined by the direction of the edge point); linking of neighboring edge points in 3 passes: starting from end points; starting from junctions; and tracing closed shapes; bridging of segments separated by only 1 pixel; and vectorization of segments by fitting polylines to them, using an iterative end-point fit method. ESA

N87-28143# Technische Univ., Graz (Austria). Inst. for Image Processing and Computer Graphics.
INTEGRATED SYSTEMS FOR REMOTE SENSING
M. F. Buchroithner *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 199-203 (For primary document see N87-28115 22-43)
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Modular software systems for evaluation of remote sensing data are described. The importance of synergism for the applied systems is pointed out and examples of practical use are given. ESA

N87-28144# Technical Univ. of Denmark, Lyngby.
COMPARISON OF VISUAL AND AUTOMATED LINEAMENT ANALYSES ON LANDSAT MSS IMAGE FROM SOUTH GREENLAND
Knut Conradsen, Bjarne K. Mielsen, John L. Petersen, and Tage Thyrsted *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 205-211 (For primary document see N87-28115 22-43)
(Contracts EXU-041-DK(G); MSM-114-DK(AD))
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A procedure for automated identification of linear features in digital imagery is described. It consists of a filtering of the image followed by a local direction estimation for each pixel. Based on these, density maps of the occurrence of linear features can be estimated for given directions. The density maps from the two procedures are compared, and the overall agreement is very high. ESA

N87-28145# Joint Research Centre of the European Communities, Ispra (Italy).
MEASUREMENT OF SPECTRAL SIGNATURES IN LESS FAVORED AREAS (LFA): A CONTRIBUTION TO THE DEFINITION OF A REMOTE SENSING MULTITEMPORAL EXPERIMENT
G. Maracci, G. Andreoli, and B. Hosgood *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 215-218 (For primary document see N87-28115 22-43)
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A multitemporal analysis criterion for classification based on ground measured spectral reflectances by means of the vegetation index was established. The possibility to express LANDSAT Thematic Mapper (TM) data in terms of spectral reflectances, once atmospheric effects are taken into account is proved and these are comparable with those measured at ground level. This step requires knowledge of the reflective properties of a reference target in the scene or the measurement of the incoming irradiance. It is possible to compare TM data of different seasons, in an objective way, for multitemporal analysis. This might be a significant contribution to the definition of a remote sensing project for less favored area management. The effect of an unidentified cause which results in too high a value of radiance in TM band 4 is noted. ESA

N87-28146# Copenhagen Univ. (Denmark). Inst. of Geophysics.
COASTAL ZONE COLOR SCANNER (CZCS) IMAGES AND OCEAN DYNAMICS. APPLICATION TO THE NORTHWEST AFRICAN UPWELLING AREA **c48**
L. Nykjaer, L. VanCamp, P. Schlittenhardt (Joint Research Centre of the European Communities, Ispra, Italy), and R. Refk *In* ESA Proceedings or the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 219-223 (For primary document see N87-28115 22-43)
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Eleven Coastal Zone Color Scanner images covering the northwest African upwelling area were processed to geometrically rectified maps of phytoplankton pigment concentrations. The spatial features visible in the satellite images are interpreted in terms of the dynamics in the area. To support this interpretation wind data were collected and processed to show parameters related to wind induced transport mechanisms in the water. From this it is evident that the differences in pigment patterns in the northern and southern part of the study area are due to differences in wind patterns. Other phenomena are explained using knowledge about the fluid forces occurring in currents and eddies. ESA

N87-28147# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Allgemeine und Angewandte Geologie.
THE IMPACT OF LANDSAT THEMATIC MAPPER DATA FOR ECOLOGICAL MAPPING PURPOSES. A CASE STUDY AT THE NORTHERN MARGIN OF THE ALPS
F. Jaskolla *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 225-230 (For primary document see N87-28115 22-43)
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The suitability of the model CORINE for ecological mapping on the European level is discussed. By an example of LANDSAT-TM data of a test site south of Munich, their high significance is demonstrated. Results show that thematic mapping scaled up to 1:50 000 is possible; the depiction of land descriptors is improved significantly; and the crucial point for use of the information content is digital image processing. ESA

N87-28148# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
LARGE SCALE SEA ICE STUDIES BASED ON SCANNING MULTICHANNEL MICROWAVE RADIOMETERS (SMMR) DATA **c48**
Peter Sloth and Leif Toudal Pedersen *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 235-238 Sponsored by the Danish Space Research, the Commission for Scientific Research in Greenland, and IBM-Denmark (For primary document see N87-28115 22-43)
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Large scale ice edge variations in the Greenland Sea were investigated through analysis of time series of data from the NIMBUS-7 Scanning Multichannel Microwave Radiometer (SMMR). Using a simple model for the relation between microwave radiances and sea ice concentration, a period from January to March was studied. Difficulties in interpreting variations in the ice edge position as observed by SMMR are discussed and illustrated through examples of the correspondence of the observed ice edge variations to different wind conditions. ESA

N87-28149# Roskilde Univ. (Denmark).
MAPPING OF VEGETATION TYPES IN SW GREENLAND
S. Folving *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 239-243 (For primary document see N87-28115 22-43)
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To help plan sheep farming in Greenland, and to get a tool with which the impact on vegetation can be monitored, general thematic maps on vegetational surface cover types were made from LANDSAT multispectral data. The climate and the poorly developed soils cause the vegetation cover to be very patchy; most often the signal recorded per pixel originates in various surface cover types. Thus traditional classifications of the data give very insufficient results. It is shown that a combination of principal component analysis and the normalized vegetation index is best suited to extract the needed information from satellite data. ESA

N87-28150# Copenhagen Univ. (Denmark). Inst. of Geography.
SNOW MAPPING IN WESTERN GREENLAND
Henrik Soegaard *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 245-249 Sponsored by the Commission for Scientific Research in Greenland (For primary document see N87-28115 22-43)
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Snow mapping in Greenland based on NOAA AVHRR data is presented. Based on data from two major drainage basins, methods for mapping snow cover and water equivalent were elaborated, and validated by field observations and hydrological simulation. It is shown that accuracy in snow cover mapping is greatly increased when a correction for terrain effects is applied and that a linear relationship between snow cover and water equivalent can be established. Applications of the results in snow-hydrology modeling, and the integration of the procedure on a microcomputer based image processing system are discussed. ESA

N87-28151# Valencia Univ. (Spain). Dept. of Thermology.
A MODEL OF THERMAL INERTIA FOR FROST FORECASTING IN AGRICULTURAL AREAS **c47**
V. Caselles, M. J. Salom, J. Delegido, and S. Gandia *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 253-257 (For primary document see N87-28115 22-43)
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The Valentian region (Spain) was classified into different thermally homogeneous zones, to carry out frost forecasting for these small zones. The classifying parameter is thermal inertia because it is considered to be a good index of the system ground-vegetation when its temperature changes. For managing frost forecasting, Price's (1977) model for thermal inertia estimate was modified by adding the evapotranspiration term. Since evapotranspiration in irrigated lands mainly depends on crops, this forecasting is made from the maximum temperature image obtained by remote sensing and the crop image. ESA

N87-28152# Ministere de l'Environment et du Cadre de Vie, Neuilly (France).
PRESENT STATE, CHANGES, AND QUALITY OF SOLOGNE AND BRENNE, TWO FRENCH LARGE WETLANDS, STUDIED WITH LANDSAT MSS AND TM DATA
Michel Lenco and Jean-Pierre Dedieu *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 259-261 (For primary document see N87-28115 22-43)
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Using LANDSAT TM and MSS data, cartographical (1:50,000 scale) and numerical information in 23 classes on the present state and the late 1975/84 changes of the watershed land cover to two large wetlands were obtained. The LANDSAT TM data processing in supervised classification mapped information about depth, aquatic vegetation, turbidity and outer temperature of the ponds in ascertaining thresholds in channels 5, 1, 2, 3, and 6. ESA

N87-28153# Joint Research Centre of the European Communities, Ispra (Italy).
CORRECTION OF THE SENSOR DEGRADATION OF THE COASTAL ZONE COLOR SCANNER ON NIMBUS-7
B. Sturm *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 263-267 (For primary document see N87-28115 22-43)
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Sensitivity loss in NIMBUS-7 Coastal Zone Color Scanner (CZCS) channels 443, 520, and 550 on nm the order of 50%, 20% and 10%, respectively, is discussed. The loss is due to a deterioration of optical surfaces positioned before the introduction of the internal calibration light sources. For quantitative

determination of chlorophyll-like pigment and total suspended matter concentrations from the CZCS data this sensitivity loss must be corrected. Sensitivity-loss correction factors are evaluated up to Orbit No. 35345 (Oct 10, 1985) by comparing measured and expected sensor aperture radiances for water with low pigment and total suspended matter concentrations (clear water). The water-leaving radiances and the optical parameters of the aerosol are assumed to vary randomly around fixed standard values. The evaluated pigment concentration is little affected by the inaccuracy of the calculated decay compensation factors because compensation for the errors occurs when the aerosol Angstrom exponent is calculated with consistent clear waterleaving radiances. ESA

N87-28154# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
ADRIA 84: AIRBORNE INVESTIGATIONS OF GELBSTOFF BY OPTICAL RADIOMETRY AND FLUORESCENCE LIDAR
V. Ammann, R. Reuter, and P. Schlittenhardt (Joint Research Centre of the European Communities, Ispra, Italy) *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 269-273 (For primary document see N87-28115 22-43)
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Gelbstoff (disolved organic matter) was used as a natural tracer for the study of transport and mixing, and for the identification of characterisüc water masses and frontal systems, in the Adriatic Sea. Airborne lidar measurements with excitation at 308 nm and 450 nm; ocean color data in the visible spectral range collected with airborne sensors (ocean color radiometer and six-channels radiometer); in-situ measurements of gelbstoff, chlorophyll, and suspended matter concentrations are summarized. ESA

N87-28155# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
TRACKING OF ICE FLOES **c48**
Peter Randrup Christensen *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 275-279 Sponsored by the Danish Space Research Commitee, the Commission for Scientific in Greenland, and IBM-Denmark (For primary document see N87-28115 22-43)
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Future position of a floe was predicted using NOAA AVHRR, from its previous position and the motion of other floes in the area. An interactive program allowing the analyst to track floes in consecutive images was developed. An improvement of the method is possible, if an automatic determination of the new position of the floe is possible. A method in which a spatial correlation technique is employed to determine the new position of the floe is investigated. Since the prediction allows the search region to be small the number of false findings is reduced. The method works well on cloud free or nearly cloud free images. The heuristic method used to pick the floe from the image may be improved by the use of an edge enhancement of an adaptative threshold determined from local values for the brightness levels of ice and water. ESA

N87-28156# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
SEA ICE OBSERVATIONS BY SAR **c48**
Henning Skriver *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 281-288 Sponsored by ESA (For primary document see N87-28115 22-43)
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Methods for sea ice parameter retrieval from synthetic aperture radar (SAR) data were investigated. Automatic parameter estimation methods are needed to cope with the huge amount of data. A pixel-by-pixel classification scheme for sea ice type determination, and a spatial segmentation scheme for studies of sea ice dynamics were assessed. The SAR data must be corrected before the parameter retrieval is carried out, i.e., radiometrically and geometrically corrected, and speckle reduced. Speckle reduction was investigated and noncoherent averaging and adaptative filtering (Lee and Frost filters) were applied. ESA

N87-28157# Roskilde Univ. (Denmark).
STUDIES OF TIDAL FLAT ENVIRONMENTS WITH LANDSAT MSS DATA **c48**
S. Folving *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 289-293 (For primary document see N87-28115 22-43)
Copyright Avail: NTIS HC A14/MF A01

Multitemporal LANDSAT data were used to classify and map tidal flats in accordance with the main sediment types found by field work. By combining imagery from 1976 with imagery from 1981 and by means of principal component analysis, it is possible to detect major changes in the sandy tidal flats, whereas changes in the silty and clayey tidal flats seem hard to detect. Multispectral measurements from aircraft, 150 m above the surface, recorded concurrently with collection of water samples were used to calibrate the satellite data. Multivariate statistical analyses were performed, and the results made it possible to map the spatial variation in concentrations of suspended matter. ESA

N87-28158# Marconi Co. Ltd., Chelmsford (England).
TEXTURE ANALYSIS IN SYNTHETIC APERTURE RADAR IMAGERY **c32**
J. Lamont and P. Klein *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 295-300 (For primary document see N87-28115 22-43)
Copyright Avail: NTIS HC A14/MF A01

Automatic analysis of texture in SAR imagery using the spatial gray level dependency matrix (SGLDM) technique is described. The identification of textured segments within an image, including the expected variation of the SGLDM measures in the presence of speckle, and the characterization of that texture are considered. Results which show that textured segments of SAR 580 imagery can be identified and characterized using the SGLDM technique are presented. ESA

N87-28159# Naval Academy, Annapolis, Md.
ANALYSIS OF GLINT PATTERNS USING REMOTE SENSING TECHNIQUES Final Report, 1986 - 1987
Deborah D. Klatt 19 May 1987 54 p
(AD-A182665; USNA-TSPR-146) Avail: NTIS HC A04/MF A01 CSCL 17I

A laboratory simulation of the spiral eddies viewed from the space shuttle Challenger on the STS 41-G mission was constructed. The construction allowed for collection of quantitative data coincident with the recording of any surface structure on polaroid film. A spiral flow was introduced into a test region, and the spiral nature of the flow verified by the plot of horizontal current velocity measurements. No manifestation of this flow, however, was evident on the water's surface. The unexpected results of the laboratory simulation provided the stimulus for a more in-depth study of the actual environmental conditions surrounding the presence of spiral eddies in the Levantine. Examination of the bathymetry revealed a direct relation between the generation and dissipation of spiral eddies, and the depth of the basin. Rotational motion of the eddies in this region is governed by the conservation of angular momentum. GRA

N87-28160# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EVALUATION OF THE RANGE AND DEGRADATION OF MANGROVES IN SOUTHERN SERGIPE WITH REMOTE SENSING TECHNIQUES [AVALIACAO DA EXTENSAO E DEGRADACAO DE MANGUEZAIS NO SUL DE SERGIPE ATRAVES DE SENSORIAMENTO REMOTO]
Myrian deMouraAbdon, Ernesto GetulioMVieira, and Carmen Regina S. Espindola Jun. 1987 26 p In PORTUGUESE; ENGLISH summary
(INPE-4196-PRE/1080) Avail: NTIS HC A03/MF A01

The purpose of this report is to estimate the mangrove population at the estuary of the rivers Piaui and Real (SE) with

remote sensing techniques, and also to evaluate any degradation of these areas associated with the growing industrialization in the region. Aerial panchromatic photos in the 1:25,000 scale from 20 December 1987 were used to produce ground truth maps where mangrove areas were identified from other ground cover features. Digital multispectral and multitemporal analysis of MSS/LANDSAT (26 March 1979) and TM/LANDSAT (19 July 1984) imagery produced thematic maps of the region. The field work conducted in the area under study furnished data that confirm the efficacy of the method used in the identification and classification of the mangrove areas. Author

N87-28161# Office of Naval Research, London (England).
PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON MICROWAVE SIGNATURES AND REMOTE SENSING
Jerome Williams 28 May 1987 13 p Symposium held in Gothenburg, Sweden, Jan. 1987
(ONRL-7-010-C) Avail: NTIS HC A02/MF A01

This symposium was attended by participants from 16 countries. Discussions covered signatures from snow and ice, solid ground, ocean surfaces, and vegetation. Radar altimetry, interactions and modeling and new sensing methods are considered. Author

N87-28162*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECTS OF AEROSOLS AND SURFACE SHADOWING ON BIDIRECTIONAL REFLECTANCE MEASUREMENTS OF DESERTS
David E. Bowker and Richard E. Davis Sep. 1987 26 p
(NASA-TP-2756; L-16327; NAS 1.60:2756) Avail: NTIS HC A03/MF A01 CSCL 04A

Desert surfaces are probably one of the most stable of the Earth's natural targets for remote sensing. The bidirectional reflectance properties of the Saudi Arabian desert was investigated during the Summer Monsoon Experiment (Summer Monex). A comparison of high-altitude with near-surface measurements of the White Sands desert showed significant differences. These discrepancies have been attributed to forward scattering of the dust-laden atmosphere prevalent during Summer Monex. This paper is concerned in general with modeling the effects of atmospheric aerosols and surface shadowing on the remote sensing of bidirectional reflectance factors of desert targets, and in particular with comparing the results of these models with flight results. Although it is possible to approximate the latter, it is felt that a surface reflectance model with a smaller specular component would have permitted using a more realistic set of atmospheric conditions in the simulations. Author

N87-28163# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Ministerio da Ciencia e Tecnologia.
A SYSTEM FOR DETERMINATION OF WIND FIELDS USING GEOSTATIONARY METEOROLOGICAL SATELLITES [UM SISTEMA PARA A DETERMINACAO DE CAMPOS DE VENTOS UTILIZANDO SATELITES METEOROLOGICOS GEOESTACIONARIOS]
Eni AlvimdeOliveira, Nelson DelfinodAvilaMascarenhas, and Alberto Waingort Setzer Apr. 1987 8 p In PORTUGUESE; ENGLISH summary Presented at the Annual Latin-American Symposium on Remote Sensing, Gramado-RS, Aug. 1986 Submitted for publication
(INPE-4161-PRE/1063) Avail: NTIS HC A02/MF A01

Wind fields are sets of vectors that indicate the velocity and the direction of the wind in a given region. These fields enable the study of the atmosphere dynamics as it describes the fluid flow in it. Since the clouds move by the action of the wind at the level where they are, their tracking allows the derivation of movements in the atmosphere. The wind fields can be obtained through cloud tracking in a sequence of geostationary meteorological satellite images, generated in known time intervals. Therefore, one can complement altitude data in the intervals between radiosondes launchings, and it is also possible to acquire data in areas not covered by radiosonding, such as oceans, and mountains. The placement of geostationary satellites approximately over the same location on the Earth allows the observation of cloud displacement in a sequence of images and the determination of wind fields. A system under development at INPE to determine wind fields through low cloud tracking in image sequences is described. Such a system comprises the following modules: image navigation; selection of clouds suitable for tracking; cloud movement determination through image registration; cloud altitude assignment; and validation of results. After completion, this system will be used by the Meteorology Department of INPE, in data acquisition for numerical weather prediction and in the analysis of individual synoptic situations. Author

N87-28164# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DETERMINATION AND EVALUATION OF THE MODULATION TRANSFER FUNCTION (MTF) FROM THE MULTISPECTRAL SCANNER (MSS) AND THEMATIC MAPPER (TM) SYSTEM (LANDSAT-5) [DETERMINACAO E AVALIACAO DAS FUNCOES DE TRANSFERENCIA DE MODULACAO (MTF) DOS SISTEMAS MSS E TM (LANDSAT-5)]
Leila Maria GarciaFonseca Jun. 1987 21 p In PORTUGUESE; ENGLISH summary
(INPE-4187-RPE/543) Avail: NTIS HC A02/MF A01

The Modulation Transfer Function (MTF) and the Linear Spread Function (LSF) for the LANDSAT-5 Multispectral Scanner (MSS) and Thematic Mapper (TM) systems are determined. A theoretical model for the optical, detector, and electronic components of the TM and MSS sensors based on the project specification is used. Sampling effects, such as aliasing and sampling uncertainty that affect the spatial resolution, are also included in the model. As illustrated, the MTF of the TM system, for the bands 1-4, is analyzed. It is observed that the effective IFOV is significantly larger than the accepted common value, particularly in the along-track direction, where undersampling contributes markedly to an increase in image blur. The results are very similar to experimental results published in other papers. Author

N87-28165# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ENHANCEMENT OF COLORS IN REMOTE SENSING IMAGES USING ROTATION OF THE MATRIX AT THE IHS COORDINATES [REALCE DE CORES EM IMAGENS DE SENSORIAMENTO REMOTO UTILIZANDO ROTACAO DE MATIZ NO ESPACO IHS]
Luciano VieiraDutra and Paulo Roberto Meneses Jul. 1987 15 p In PORTUGUESE; ENGLISH summary Presented at the 5th Brazilian Symposium of Telecommunication, Campinas, Brazil, 8-10 Sep. 1987
(INPE-4207-PRE/1088) Avail: NTIS HC A02/MF A01

The multispectral color composite imagery, obtained by digital processing and displayed on video monitors through the combination of the fundamental colors red, green, and blue, consists in an efficient form of presentation. The visual or psychophysiologic perception of the brain to the stimulus of particular colors, tends to combine independently the quantitative components of the fundamental colors, the intensity (I), hue (H) and saturation (S), and so it is possible to perceive each one of these attributes of color, separately. A method is presented to increase the contrast of the colors, using a transformation to the IHS coordinates which permits individual manipulation in each of these components, in order to obtain a better control about the color composite generated in the video display. The basic procedure is a manipulation of the histograms of the components, I, H, and S, in order to increase, decrease, or offset the range of possible values of the components, by linear transformations. Test of this procedure using LANDSAT-TM scene of a region covered by geological research showed the different component manipulations resulted in different enhancements of lithologic units, formerly not distinguished in the original color composition, which allowed an easier photogeologic interpretation. Author

N87-27696# Joint Publications Research Service, Arlington, Va.
SUCCESSES OF COSMOS-1500 SATELLITE, SLR SYSTEM

Yuriy Andreotti *In its* USSR Report: Space 21 Apr. 1986 p 100-103 Transl. into ENGLISH from APN: Advances of Science and Technology (Moscow, USSR), no. 21, 5 Nov. 1985 p 1-5 (For primary document see N87-27687 22-12)
Avail: NTIS HC A07/MF A01

N87-27824# Joint Publications Research Service, Arlington, Va.
REMOTE SENSING OF ATMOSPHERE TEMPERATURE FROM SPACTRAL RADIOMETRIC MEASUREMENTS AT 5 MILLIMETER WAVELENGTH LINE Abstract Only
A. V. Troitskiy *In its* USSR Report: Electronics and Electrical Engineering 6 Aug. 1987 p 9 Transl. into ENGLISH from Izvestiya Vysshikh Uchebnykh Zavedeniy: Radiofizika (Gorkiy, USSR), v. 29, no. 8, Aug. 1986 p 878-887 (For primary document see N87-27821 22-31)
Avail: NTIS HC A05/MF A01

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *28 Propellants and Fuels.*

N87-28166# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
MOCVD TECHNIQUES FOR CADMIUM TELLURIDE SOLAR CELLS Annual Subcontract Report, 15 Feb. 1985 - 15 Feb. 1986
D. E. Schafer Feb. 1987 49 p
(Contract DE-AC02-83CH-10093)
(DE87-001154; SERI/STR-211-3031) Avail: NTIS HC A03/MF A01

This report summarizes the application of metal-organic chemical vapor deposition (MOCVD) film-growth technique to two aspects of CdTe/ITO solar cell fabrication: the growth of large-area CdTe films on ITO and the formation of low-resistance ohmic contacts to p-type CdTe. In this work, UV-assisted MOCVD was developed for the deposition of CdTe films to lower the growth temperature and minimize the tendency of damage to the ITO layer. Also, MOCVD growth of HgTe was developed as an ohmic contact metallization to the CdTe layer of the photovoltaic structure. This report details the MOCVD reactor geometries and process parameters used in the development of the CdTe and HgTe layer growth, as well as the results of Auger analysis of layer composition and interlayer diffusion, X-ray analysis of film crystallinity, and electrical analysis of HgTe/CdTe specific contact resistance. DOE

N87-28167# Sandia National Labs., Albuquerque, N. Mex.
THE 1987 PHOTOVOLTAICS ANNUAL SYSTEMS SYMPOSIUM: AGENDA AND ABSTRACTS
R. N. Chapman Feb. 1987 68 p Symposium held at Austin, Tex., 18 Feb. 1987
(Contract DE-AC04-76DP-00789)
(DE87-006334; SAND-87-0097-Summ; CONF-870263-Summ)
Avail: NTIS HC A04/MF A01

The 1987 Photovoltaic Annual Systems Symposium (PASS'87) is being held at La Mansion Hotel, February 18, 19, and 20, 1987, in Austin, Texas. The meeting is sponsored by Sandia National Laboratories, the US Department of Energy, and the City of Austin Electric Utility Department. This document contains a summary of the findings from PASS'86, the agenda for PASS'87, and extended abstracts describing the PASS'87 presentations. The technical program is divided into five sessions: Department of Energy Program Directions, National and State Photovoltaic Activities, Subsystem Technology, Utility Interface Issues, and Stand-Alone Systems. A panel discussion scheduled for the afternoon of the 19th will focus on the utilities' perception of photovoltaics. A tour of Austin's 300 kW Solar Photovoltaic Test Facility is available to those attending the symposium. DOE

N87-28168# Vactronic Lab. Equipment, Inc., East Northport, N.Y.
RESEARCH ON HIGH-EFFICIENCY, SINGLE-JUNCTION, MONOLITHIC, THIN-FILM AMORPHOUS SILICON SOLAR CELLS Annual Subcontract Report, May 1985 - Jul. 1986
H. Wiesmann, J. Dolan, G. Fricano, and V. Danginis Feb. 1987 89 p Prepared in cooperation with Midwest Research Inst., Golden, Colo.
(Contract DE-AC02-83CH-10093)
(DE87-001146; SERI/STR-211-3097) Avail: NTIS HC A05/MF A01

A study was undertaken of the optoelectronic properties of amorphous silicon-hydrogen thin films deposited from disilane at high deposition rates. The information derived from this study was used to fabricate amorphous silicon solar cells with efficiencies exceeding 7%. The intrinsic layer of these solar cells was deposited at 15 angstroms/second. Material properties investigated included dark conductivity, photoconductivity, minority carrier diffusion length, and density of states. The solar cells properties characterized were absolute quantum yield and simulated global AM 1.5 efficiencies. Investigations were undertaken utilizing optical and infrared spectroscopy to optimize the microstructures of the intrinsic amorphous silicon. That work was sponsored by the New York State Energy Research and Development Authority. The information was used to optimize the intrinsic layer of amorphous silicon solar cells, resulting in AM 1.5 efficiencies exceeding 7%. DOE

N87-28169# International Solar Electric Technology, Inglewood, Calif.
HIGH-EFFICIENCY, COOPER TERNARY, THIN-FILM SOLAR CELLS Annual Subcontract Report, 1 May 1985 - 30 Apr. 1986
V. K. Kapur, B. M. Basol, and E. S. Tseng Feb. 1987 37 p Prepared in cooperation with Midwest Research Inst., Golden, Colo.
(Contract DE-AC02-83CH-10093)
(DE87-001147; SERI/STR-211-3030) Avail: NTIS HC A03/MF A01

A new, two-stage process for depositing CuInSe2 films has been developed. In this method, copper and indium metal layers were sequentially electroplated onto a molybdenum-coated glass substrate with a fixed Cu/In ratio. This metal stack was selenized at 400°C under an atmosphere of H2Se gas. Single-phase InSe2 films thus obtained were used to fabricate CuInSe2/CdS solar cells. Evaporated CdS films were used for device fabrication. Solar cells 1.0 sq cm in area had a conversion efficiency in the range of 7.0% to 7.3% without an antireflection coating. Correcting for the reflective losses and the grid shading, the active area efficiency for these cells was projected to be around 10.0%. DOE

N87-28170# Sandia National Labs., Albuquerque, N. Mex.
DEVELOPMENT OF SIZING NOMOGRAMS FOR STAND-ALONE PHOTOVOLTAIC/STORAGE SYSTEMS
R. N. Chapman May 1987 18 p Presented at Solar '87: 12th National Passive Solar Conference, Portland, Oreg., 12 Jul. 1987
(Contract DE-AC04-76DP-00789)
(DE87-008929; SAND-87-1119C; CONF-870711-3) Avail: NTIS HC A02/MF A01

This paper described the development of a simplified technique for sizing stand-alone photovoltaic/storage systems. The sizing criterion is the long-term loss-of-load probability which is the fraction of the total energy demand that the photovoltaic system will not be able to satisfy over a 23 year period. The technique was derived using 23 years of hourly insolation data from 20 US weather stations. These data were used to develop correlations between the variability in insolation and average monthly horizontal insolation. The correlations were then used to generate sizing nomograms that give the array size as a function of average horizontal insolation and the storage capacity as a function of the

long-term loss-of-load probability. The technique is valid for systems with a fixed tilt array, product or energy storage, and any hourly or daily demand profile provided that the average monthly demand does not vary by more than +/-10% from month to month.
DOE

N87-28171# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
AEROELASTIC RESEARCH ON TIP VANE WIND TURBINES Final Report
W. Kuik Jan. 1985 34 p Sponsored by the Zuiver Wetenschappelijk Onderzoek and the Netherlands Foundation for Technical Res earch
(VTH-LR-449; B8707431; ETN-87-90198) Avail: NTIS HC A03/MF A01
Mathematical modeling of the aeroelastic stability of the tip vane rotor, concerning pitch-flap and stall flutter is discussed. The influence of the aerodynamic forces of the tip vane on stability was investigated by experiments on a one bladed wind tunnel model of a tip vane rotor. The theoretical and the wind tunnel models can be of use for wind turbine rotors with flexbeams and passive pitch control by centrifugal weights instead of tip vanes.
ESA

N87-28172# Sandia National Labs., Albuquerque, N. Mex.
THE FUNDAMENTALS OF PHOTOVOLTAIC SYSTEM ELECTRICAL DESIGN
D. Menicucci and T. Key 1987 2 p Presented at Solar '87: 12th National Passive Solar Conference, Portland, Oreg., 12 Jul. 1987
(Contract DE-AC04-76DP-00789)
(DE87-005908; SAND-87-0162C; CONF-870711-2) Avail: NTIS HC A02/MF A01
This paper introduces the basic fundamentals of the design of electrical equipment for photovoltaic systems. DOE

N87-28173# Sandia National Labs., Albuquerque, N. Mex.
PHOTOVOLTAIC SYSTEMS FOR CURRENT AND FUTURE APPLICATIONS
H. N. Post and M. G. Thomas 1987 12 p Presented at Solar '87: 12th National Passive Solar Conference, Portland, Oreg., 12 Jul. 1987
(Contract DE-AC04-76DP-00789)
(DE87-006122; SAND-87-0168C; CONF-870711-1) Avail: NTIS MF A01
Presented is an examination of photovoltaic power system applications, including remote stand-alone, dispersed grid-connected and large generation centers. Photovoltaic system options for both current and future applications are described and costs for each of these options are developed. The results of this examination show that future applications will utilize the system technology available today and subsystem technology advances can be accommodated through minor system changes. DOE

N87-28174# Stirling Thermal Motors, Inc., Ann Arbor, Mich.
REFLUX HEAT-PIPE SOLAR RECEIVER FOR A STIRLING DISH-ELECTRIC SYSTEM
B. Ziph, T. M. Godett, and R. B. Diver 1987 18 p Presented at the 22nd Intersociety Energy Conversion Engineering Conference, Philadelphia, Pa., 10 Aug. 1987 Prepared in cooperation with Sandia National Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(DE87-009289; SAND-86-2828C; CONF-870804-1) Avail: NTIS HC A02/MF A01
The feasibility of competitive, modular bulk electric power from the Sun is enhanced by the use of a reflux heat-pipe receiver to combine a Stirling engine with a paraboloidal dish concentrator. This combination represents a potential improvement over previous successful demonstrations of Stirling dish-electric technology in terms of enhanced performance, lower cost, and longer life. In the reflux (i.e., gravity assisted) heat-pipe receiver, concentrated solar radiation causes liquid sodium to evaporate, the vapor flows to the Stirling engine heaters where it condenses on the heater tubes. The condensate is returned to and distributed over the receiver by gravity (refluxing) and by capillary forces in a wick lining the receiver. It is essentially an adaptation of sodium heat pipe technology to the peculiar requirements of concentrated solar flux and provides many potential advantages over conventional tube receiver technology. Described is the preliminary design of a reflux heat-pipe solar receiver to match the STM4-120 variable swashplate Stirling engine to a Test Bed Concentrator at the Sandia test facility. Performance analysis and other design considerations are presented and discussed. DOE

N87-28175# Oak Ridge National Lab., Tenn.
ASSESSMENT OF ENERGY STORAGE CONCEPTS FOR USE IN PULSED SPACE POWER SYSTEMS
M. Olszewski and D. G. Morris 1987 15 p Presented at the 22nd Intersociety Energy Conversion Engineering Conference, Philadelphia, Pa., 10 Aug. 1987
(Contract DE-AC05-84OR-21400)
(DE87-009681; CONF-870804-5) Avail: NTIS HC A02/MF A01
Preliminary assessments have been completed for thermal energy storage in heat rejection systems as well as for regenerable electrical storage modules in systems having nuclear sources with Rankine power conversion and solar sources with Brayton and Rankine power conversion. Storage technologies considered for the regenerable modules include flywheels, batteries, fuel cells, superconducting magnets and capacitors. Both source and sink thermal storage were examined for the solar energy based systems. Benefits derived from incorporating thermal storage in the heat rejection system depend on the storage density and the radiator specific mass. The analysis shows that inclusion of a thermal store results in heat rejection system mass reductions for generation times of up to 1100 seconds. Results show that the storage system value (mass reduction) increases with decreasing total generation time. In general, the value is greatest for generation times of 600 seconds or less although mass savings are realized for generation times nearly twice as long. For a total generation time of 500 seconds, incorporating storage in a nuclear Rankine power system results in a mass reduction of 50%. System masses similar to the nuclear Rankine are obtainable for solar Rankine and Brayton cycles using regenerable electrical storage modules. However, a 100-orbit recharge time is required, when the constraint of keeping concentrator areas smaller than 1000 sq m is also imposed. DOE

N87-28176# Oregon State Univ., Corvallis. Wind Resources Assessment Lab.
REGIONAL WIND ENERGY ASSESSMENT PROGRAM, APPENDIX Progress Report, Oct. 1984 - Sep. 1985
J. E. Wade, R. W. Baker, K. Redmond, R. J. Wittrup, and J. Buckley Jul. 1986 159 p
(Contract DE-AC79-81BP-25593)
(DE87-010348; DOE/BP-25593/2-App; BPA-86-22-App) Avail: NTIS HC A08/MF A01
This report summarizes the wind statistics gathered at 65 sites in the BPA wind network over the period June 1984 through May 1985. The analysis of these data completes the BPA Regional Wind Energy Assessment Program (WIND REAP) that has been ongoing since 1981. A climatological analysis of 12 selected sites distributed throughout the entire BPA service area indicated that fall winds were stronger than normal, spring winds were about normal and winter winds were significantly weaker than normal. There was considerable variation throughout the region in the wind's difference from normal during the summer months. Temperature, pressure and precipitation data were also analyzed for several National Weather Service sites. The trends in precipitation and to a lesser extent temperature followed those of wind speeds. In the fall, stronger than normal winds were related to greater than normal precipitation. During the winter, colder and drier conditions were associated with below normal winds. DOE

N87-28177# Otago Univ., Dunedin (New Zealand). Dept. of Physics.
SMALL SCALE WIND POWER GUIDE FOR NEW ZEALAND, AUSTRALIA AND THE SOUTH PACIFIC
P. J. Edwards Nov. 1986 90 p Prepared in cooperation with New Zealand Energy Research and Development Committee, Auckland
(DE87-900758; NZERDC-136) Avail: NTIS (US Sales Only) HC A05/MF A01

This report reviews the present and potential use of wind energy in small-scale applications with particular reference to New Zealand and Australia. The report is written in the form of a systems level guide to potential users and designers of wind power systems who have little or no prior knowledge in this field. The main emphasis is on remote area electric power supply applications, as these are continuing to attract interest despite the lower oil prices of the mid 1980s. Specialist and traditional applications such as electric fencing and water pumping are well documented elsewhere. The guide provides a basis for a systematic approach to the systems level design and component selection and the technical and financial evaluation of wind power supply systems. Examples of typical power and energy demands, New Zealand site characteristics and systems are given in the text, culminating in a number of Design Case Studies. A set of ten Design Guide Sheets are used to assist and illustrate the design process. These are reproduced in the text and in the Appendices. DOE

N87-28178*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MATHEMATICAL MODELING OF A PHOTOVOLTAIC-LASER ENERGY CONVERTER FOR IODINE LASER RADIATION
Gilbert H. Walker and John H. Heinbockel (Old Dominion Univ., Norfolk, Va.) Jul. 1987 15 p
(NASA-TM-100482; NAS 1.15:100482) Avail: NTIS HC A02/MF A01 CSCL 10A

Space-based laser power systems will require converters to change laser radiation into electricity. Vertical junction photovoltaic converters are promising devices for this use. A promising laser for the laser power station is the t-C4F9I laser which emits radiation at a wavelength of 1.315 microns. This paper describes the results of mathematical modeling of a photovoltaic-laser energy converter for use with this laser. The material for this photovoltaic converter is Ga(53)In(47)As which has a bandgap energy of 0.94 eV, slightly below the energy of the laser photons (0.943 eV). Results of a study optimizing the converter parameters are presented. Calculated efficiency for a 1000 vertical junction converter is 42.5 percent at a power density of 1 x 10 to the 3d power w/sq cm.
Author

N87-28179# Sandia National Labs., Albuquerque, N. Mex.
PROGRESS TOWARD A MERCURY HEAT ENGINE: SYNTHESIS OF A MERCURY ELECTROLYTE
W. F. Hammetter, G. C. Farrington, and E. E. Hellstrom Jun. 1987 16 p Presented at the 22nd Intersociety Energy Conversion Engineering Conference, Philadelphia, Pa., 10 Aug. 1987 Prepared in cooperation with Pennsylvania Univ., Philadelphia and Wisconsin Univ., Madison
(Contract DE-AC04-76DP-00789)
(DE87-010034; SAND-87-1306C; CONF-870804-6) Avail: NTIS HC A02/MF A01

Liqud metal thermal-electric converters (LMTECs) are being evaluated for terrestrial solar energy conversion applications. To meet current energy cost goals, an efficiency greater than that presently obtainable from Na-LMTEC's is required. One way to increase efficiency is to use Hg as the working fluid. Calculations have shown that the projected efficiency of a Hg-LMTEC solar system is approximately 25% as compared to about 16% for a Na-LMTEC system. The increased efficiency arises from a lower working temperature range (400 to 600 C vs 800 to 1000 C) and higher pressure over the liquid metal (several tens of atmosphere vs. about 1 atmosphere). However, a suitable Hg(II) conducting electrolyte does not exist. Successful development of a mercury heat engine requires the development of a suitable Hg electrolyte. This paper describes the necessary properties of such an electrolyte, and the efforts to attain it. Described are ion-exchange experiments on single crystals of Na(I) beta'' - alumina and some important properties of partially exchanged crystals reported. Approximately 60% of the monovalent ions in the starting crystals have been replaced after about 300 hours in the exchange media. DOE

N87-28180# Argonne National Lab., Ill.
MONOLITHIC FUEL CELLS
D. C. Fee, M. C. Billone, D. E. Busch, D. W. Dees, J. Dusek, T. E. Easler, W. A. Ellingson, B. K. Flandermeyer, R. J. Fousek, and J. J. Heiberger 1987 14 p Presented at the 22nd Intersociety Energy Conversion Engineering Conference, Philadelphia, Pa., 10 Aug. 1987
(Contract W-31-109-eng-38)
(DE87-011383; CONF-870804-16) Avail: NTIS HC A02/MF A01

A new fuel cell design, called the monolithic fuel cell, is being developed at Argonne National Laboratory. The monolithic design employs the same thin ceramic components used in other oxide fuel cells in a strong, lightweight honeycomb structure of small cells, and thus can achieve very high power per unit mass or volume. The light weight and low volume, as well as the efficiency and reliability of electrical systems, are advantageous in space. Considerable progress has been made in developing monolithic fuel cells. Small arrays (stacks) of monolithic fuel cells having prototypical dimensions have been fabricated and operated.
DOE

N87-28181# Argonne National Lab., Ill.
PREDICTING TOLUENE DEGRADATION IN ORGANIC RANKINE-CYCLE ENGINES
R. L. Cole, J. C. Demirgian, and J. W. Allen 1987 8 p Presented at the 22nd Intersociety Energy Conversion Engineering Conference, Philadelphia, Pa., 10 Aug. 1987
(Contract W-31-109-eng-38)
(DE87-011385; CONF-870804-17) Avail: NTIS HC A02

This paper describes the measurement of toluene degradation in dynamic loop tests that simulate operation of an organic Rankine-cycle engine. Major degradation products and degradation mechanisms are identified, and degradation is quantified. Results indicate that toluene is a stable fluid with benign degradation products, provided that oxygen is excluded from the engine. A means of predicting degradation in the engine is developed.
DOE

N87-28182# Lincoln Coll., Canterbury (New Zealand). Dept. of Agricultural Engineering.
WIND ENERGY RESOURCE SURVEY OF NEW ZEALAND. PHASE 1: NATIONAL SURVEY USING EXISTING DATA, DETAILED TECHNICAL REPORT
V. Smyth Jan. 1987 152 p Prepared in cooperation with New Zealand Energy Research and Development Committee, Auckland
(DE87-900816; NZERDC-P-114) Avail: NTIS (US Sales Only) HC A08/MF A01

The New Zealand Wind Energy Resource Survey provides an overview of wind energy in New Zealand in terms of supply and demand. Supply is related to the meteorology and geography of the country. The general problems of extrapolation and interpolation of wind data both in space and time are discussed and current knowledge reviewed. The indications using available wind data are that there is an abundance of wind turbine sites with mean wind speeds high enough to drive conventional large-scale turbines economically. The limitation on wind power usage would be the ability of the electricity grid to accept the fluctuating supply rather than the magnitude of the supply. A complete assessment of the economics of wind power requires simulation of the grid operation. However, there are several points favorable to wind power which are elucidated. New Zealand has a hydro-based electricity system and this is particularly suitable for the incorporation of wind power. The geographical extent of the country permits the output from

windpower to be steadied considerably by dispersing the turbine network widely. The supply of wind at times of high demand and high hydro storage water value is generally average to high. However, on an inter-annual scale, dry years may be accompanied by lighter winds. DOE

N87-28183# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

HIGH-RATE DEPOSITION OF HYDROGENATED AMORPHOUS SILICON FILMS AND DEVICES

W. Luft Apr. 1987 75 p

(Contract DE-AC02-83CH-10093)

(DE87-001165; SERI/TR-211-3052) Avail: NTIS HC A04/MF A01

This report summarizes the status of high-rate deposition technologies associated with amorphous silicon thin films for photovoltaic applications. The report lists: (1) deposition rates for a-Si:H according to source and method, and (2) efficiencies and other parameters of a-Si:H solar cells. Two main deposition source materials, silane and disilane, are discussed, as well as effects of boron doping. The effects of various deposition parameters on film characteristics and on deposition rate are presented, along with the effects of annealing on high deposition rate films. Light induced effects are also discussed. Finally, progress and problems in this field of study are summarized. DOE

N87-28184# California Univ., Berkeley. Lawrence Berkeley Lab. Applied Science Div.

SOLAR RADIANT HEATING OF GAS-PARTICLE MIXTURES Summary Report, FY 1984

A. J. Hunt, J. Ayer, P. Hull, R. McLaughlin, F. Miller, J. E. Noring, R. Russo, and W. Yuen Jun. 1986 71 p

(Contract DE-AC03-76SF-00098)

(LBL-20447; UC-62c) Avail: NTIS HC A04/MF A01

An innovative solar receiver using very small particles dispersed in a gas to directly absorb concentrated solar radiation was studied. A survey of chemical reactions in or between the gases and absorbing solids was performed. A number of suitable reactions were identified and optical, physical, and chemical data were obtained from the the solids involved. The optical properties of gas-particle mixtures were studied by developing computer codes to predict their absorption and scattering. Heat transfer properties of gas-particle mixtures were studied and a model was developed to predict energy flows between particles and gases. A laboratogy program was carried out to verify the calculations, measure properties of gas-particle mixtures, air experience and to explore high flux radiant reactions. B.G.

N87-28185# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Laboratorio Associado de Sensores e Materiais.

SIMULTANEOUS RADIATION DAMAGE AND THERMAL ANNEALING OF SOLAR CELLS

R. Kishore Mar. 1987 12 p Presented at the 19th IEEE Photovoltaic Specialists Conference, New Orleans, La., 4-8 May 1987

(INPE-4141-PRE/1049) Avail: NTIS HC A02/MF A01

A phenomenological theory of the simultaneous radiation damage and first order thermal annealing of space solar cells has been developed. The effective electron fluence and thereby the efficiency reduction of GaAs and InP solar cells are calculated as a function of time for a rectangular pulse model of the space thermal cycle. It is found that the efficiency of GaAs solar cells reduces with time but InP solar cells do not show any reduction in their efficiency. Author

N87-28186# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

COMPUTER MODELING OF HIGH-VOLTAGE SOLAR ARRAY EXPERIMENT USING THE NASCAP/LEO (NASA CHARGING ANALYZER PROGRAM/LOW EARTH ORBIT) COMPUTER CODE M.S. Thesis

Karl O. Reichl, Jr. Jun. 1987 211 p

(AD-A182589; AFIT/GE/ENG/87J-2) Avail: NTIS HC A10/MF A01 CSCL 10B

The relationship between the Interactions Measurement Payload for Shuttle (IMPS) flight experiment and the low Earth orbit plasma environment is discussed. Two interactions (parasitic current loss and electrostatic discharge on the array) may be detrimental to mission effectiveness. They result from the spacecraft's electrical potentials floating relative to plasma ground to achieve a charge flow equilibrium into the spacecraft. The floating potentials were driven by external biases applied to a solar array module of the Photovoltaic Array Space Power (PASP) experiment aboard the IMPS test pallet. The modeling was performed using the NASA Charging Analyzer Program/Low Earth Orbit (NASCAP/LEO) computer code which calculates the potentials and current collection of high-voltage objects in low Earth orbit. Models are developed by specifying the spacecraft, environment, and orbital parameters. Eight IMPS models were developed by varying the array's bias voltage and altering its orientation relative to its motion. The code modeled a typical low Earth equatorial orbit. NASCAP/LEO calculated a wide variety of possible floating potential and current collection scenarios. These varied directly with both the array bias voltage and with the vehicle's orbital orientation. GRA

N87-28187# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

SOLID ABSORBTION CYCLE SOLAR ENERGY: REFRIGERATORS

Jorgdieter Anhalt and Walter Gill Feb. 1987 16 p Presented at the 2nd Latin American Congress of Heat and Mass Transfer, Sao Paulo, Brazil, 12-15 May 1986

(INPE-4114-RPE/537) Avail: NTIS HC A02/MF A01

There has been recent worldwide interest in the development of solar thermal powered refrigerators utilizing a solid absorber system. Three proposed absorber-working fluid combinations are examined: zeolite/water; calcium chloride/ammonia; and activated charcoal/alcohol. Experiments with the zeolite/water system are also discussed. It is concluded that the proper activation of the solid absorbent, heat transfer in the solar collector, and the circuit design have the greatest influence on the maximum energy conversion efficiency obtainable. Author

N87-28188*# International Fuel Cells Corp., South Windsor, Conn.

DEVELOPMENT OF AN ALKALINE FUEL CELL SUBSYSTEM Final Program Summary Report, 10 Apr. 1986 - 31 Mar. 1987

31 Mar. 1987 94 p

(Contract NAS9-17613)

(NASA-CR-172002; NAS 1.26:172002) Avail: NTIS HC A05/MF A01 CSCL 10A

A two task program was initiated to develop advanced fuel cell components which could be assembled into an alkaline power section for the Space Station Prototype (SSP) fuel cell subsystem. The first task was to establish a preliminary SSP power section design to be representative of the 200 cell Space Station power section. The second task was to conduct tooling and fabrication trials and fabrication of selected cell stack components. A lightweight, reliable cell stack design suitable for the SSP regenerative fuel cell power plant was completed. The design meets NASA's preliminary requirements for future multikilowatt Space Station missions. Cell stack component fabrication and tooling trials demonstrated cell components of the SSP stack design of the 1.0 sq ft area can be manufactured using techniques and methods previously evaluated and developed. Author

N87-27693# Joint Publications Research Service, Arlington, Va.

IKI DEPARTMENT HEAD ON ORBITAL POWER PLANTS

Yuriy Zaitsev *In its* USSR Report: Space 21 Apr. 1986 p 67-69 Transl. into ENGLISH from APN: Advances of Science and Technology (Moscow, USSR), no. 22, 20 Nov. 1985 p 1-4

(For primary document see N87-27687 22-12)

Avail: NTIS HC A07/MF A01

45 ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

N87-28189# Northrop Services, Inc., Research Triangle Park, N. C.
DETERMINATION OF ABSORBED DOSE OF OZONE (O3) IN ANIMALS AND HUMANS USING STABLE ISOTOPE (OXYGEN-18) TRACING
G. E. Hatch and M. Aissa May 1987 25 p
(Contract EPA-68-02-4032)
(PB87-191706; EPA/600/D-87/139) Avail: NTIS HC A02/MF A01 CSCL 13B

A method for the determination of absorbed dose of ozone (O3) in animals and humans using oxygen-18 (18)O as a physiological tracer is presented. The experimental aspects of the method are based on the instantaneous pyrolysis of tissue samples and subsequent conversion of the sample oxygen to carbon monoxide then to carbon dioxide whose isotopic composition is determined by isotope-ratio mass spectrometry. A mathematical procedure is then used to correct the isotopic data for interferences from the blank and memory effects and from the iodine pentoxide oxidation of CO to CO2. Laboratory animals were exposed to (18)O3 (1 ppm, 1 hr) then tissues were dried and processed for (18)O measurement. Enrichments in (18)O over natural abundance (18)O was observed in lung homogenates, nasal cavities, trachea, and pulmonary lavage fluids but not in blood of mice, rats, and rabbits. Thus, the (18)O tracing method appears to be sensitive enough to detect the reaction products of (18)O in animals exposed to near environmental concentrations of this gas. GRA

N87-28190# Oak Ridge National Lab., Tenn.
EFFECTS OF OZONE ON FORESTS IN THE NORTHEASTERN UNITED STATES
M. B. Adams and G. E. Taylor, Jr. 1987 51 p Presented at the Ozone Risk Communication Conference, Amherst, Mass., 21 Apr. 1987
(Contract DE-AC05-84OR-21400)
(DE87-010887; CONF-8704155-1) Avail: NTIS HC A04/MF A01

Methodologies for characterizing O3 air quality are reviewed, with particular reference to forests in the northeastern United States. It is proposed that analyses be more ecologically and physiologically based. In particular, exposure statistics are recommended that (1) capture the temporal and spatial characteristics of O3 air quality, (2) incorporate an understanding of the ecological properties of the pollutant and the physiological sensitivity of forest trees, and (3) recognize the pollutant's unique chemical attributes that make it distinct from other pollutants. With respect to forest ecosystems in the Northeast, the most distinctive feature of O3 air quality is the dynamics of episodically high O3 concentrations during the growing season. O3 concentrations of 50 ppB or greater for a 28-day exposure period were found to affect growth and yield of sensitive forest species. However, the majority of species require substantially longer exposure or higher concentrations before growth reductions occur. In mixed stands, the most probable effects of O3 stress will be subtle, long-term shifts in species composition, due to impacts on sensitive individuals or species. DOE

N87-28191# Oak Ridge National Lab., Tenn.
ENVIRONMENTAL EFFECTS OF CHLOROFLUOROCARBONS: WILL RESTRICTIONS BE NEEDED
A. M. Perry Oct. 1986 92 p
(Contract DE-AC05-84OR-21400)
(ORNL/TM-9817) Avail: NTIS HC A05/MF A01

A method was devised for estimating ozone depletion for various assumptions regarding the future release of chlorocarbons (CLCs) into the atmosphere. The method is calibrated against published results obtained with more elaborate models of atmospheric chemistry. The method is applied for various scenarios for future CLC emissions, with and without emission controls. Estimates are also made of the climatic effects of CLC emissions, as represented by the average surface temperature of the Earth. It is concluded that current rates of emission present no immediate danger to the Earth and its inhabitants and would not do so for many decades. However, growth in CLC emissions at 3%/year or more, as seems likely, would eventually lead to unacceptable changes both in total ozone density and in surface temperature. Although no corrective action appears necessary at present, given the long times needed to develop and introduce substitutes or to implement effective emission controls, such actions may be necessary within the next one to three decades. M.G.

N87-28192# Pacific Northwest Labs., Richland, Wash.
UNCERTAINTY IN FUTURE GLOBAL ENERGY USE AND FOSSIL FUEL CO2 EMISSIONS 1975 TO 2075
J. A. Edmonds, J. M. Reilly, R. H. Gardner, and A. Brenkert (Science Applications International Corp., Oak Ridge, Tenn.) Dec. 1986 103 p
(Contract DE-AC05-76OR-0033)
(DOE/NBB-0081) Avail: NTIS HC A06/MF A01

The results of work with the IEA/ORAU Lone-Term Global Energy-CO2 model to analyze model predictions of future global carbon emissions from fossil fuel use and the uncertainty surrounding such forecasts are documented. The methodology utilized state-of-the-art techniques of uncertainty analysis along with review and revision of the IEA/ORAU model structure, and review and description of uncertainty surrounding model assumptions and parameters to explore uncertainty in fossil fuels CO2 emissions of the 1975975 - 20767. Possible interrelationships among assumptions and parameters, and their effects on overall forecast uncertainty are explored. B.G.

N87-28193# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
OZONE MEASUREMENTS IN THE AMAZON
V. W. J. H. Kirchhoff Jul. 1987 4 p
(INPE-4238-PRE/1113) Avail: NTIS HC A02/MF A01

Scientists of the Brazilian Institute for Space Research went to Manaus in the central region of the Brazilian rain forest during July to August 1985 to measure atmospheric chemistry, especially ozone content. Results are described. Author

N87-28194# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ANTARCTIC OZONE DEPLETION AND OZONE MEASUREMENTS IN BRAZIL
Y. Sahai, R. P. Kane, and N. R. Teixeira Jul. 1987 15 p Presented at the 39th Annual Meeting of the SBPC, Jul. 1987 Submitted for publication
(Contract FINEP-537/CT)
(INPE-4236-PRE/1111) Avail: NTIS HC A02/MF A01

Recent satellite and ground based observations of depletion of atmospheric ozone in Antarctic region during spring (October) have attracted world wide attention of scientists due to possible global environmental implications. Measurements of the total atmospheric ozone started at this Institute at Cachoeira Paulista (22.7 deg S, 45.0 deg W), SP, using a Dobson spectrophotometer in 1974. In 1978, another station was added at Natal (5.8 deg S, 35.2 deg W), RN, in collaboration with the National Oceanic and Atmospheric Administration, Boulder, Co. Both the stations carry out regular total ozone measurements and with Huancayo (12.0 deg S, 65.3 deg W), Peru, and Buenos Aires (34.5 deg S, 48.7 deg W), Argentina, form a chain of four stations in the South America. A comparative study of the ozone measurements in Brazil in relation to other South America and Antarctic stations is presented. It is shown that the Antarctic ozone depletion does not extend to the middle and low latitudes. Author

N87-28075# Joint Publications Research Service, Arlington, Va.
REEXAMINATION OF IDEAS RELATING TO CARBON DIOXIDE PROBLEM Abstract Only.
S. P. Gorshkov *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 2 Transl. into ENGLISH from Izvestiya Vsesoyuznogo Geofraficheskogo Obshchestva (Leningrad, USSR), v. 118, no. 4,

Jul. - Aug. 1986 p 297-305 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

N87-28131# Catania Univ. (Italy). Dept. of Engineering.
REMOTE SENSING INVESTIGATION OF THE OIL SPILL IN THE MESSINA STRAIT, ITALY
A. L. Geraci, G. LaRosa, and L. DelRe (Italian Navy, Spezia.) *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 109-114 (For primary document see N87-28115 22-43)
Copyright Avail: NTIS HC A14/MF A01

N87-28135# Dundee Univ. (Scotland). Physics Lab.
ON THE USE OF AVHRR CHANNEL-3 DATA FOR ENVIRONMENTAL STUDIES
A. P. Cracknell and M. C. Dobson *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 137-144 (For primary document see N87-28115 22-43)
Copyright Avail: NTIS HC A14/MF A01

N87-28141# North East London Polytechnic, Dagenham (England). Dept. of Land Surveying.
ENVIRONMENTAL INFORMATION AND CARTOGRAPHY
Richard K. Bullard and Robert W. Dixon-Gough *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 189-194 (For primary document see N87-28115 22-43)
Copyright Avail: NTIS HC A14/MF A01

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N87-28195*# Washington State Univ., Pullman. Dept. of Agronomy and Soils.
SPECTRAL CHARACTERISTICS AND THE EXTENT OF PALEOSOLS OF THE PALOUSE FORMATION Semiannual Progress Report No. 4
B. E. Frazier, Alan Busacca, Yaan Cheng, David Wherry, Judy Hart, and Steve Gill Aug. 1987 23 p
(Contract NAS5-28758)
(NASA-CR-181208; NAS 1.26:181208) Avail: NTIS HC A02/MF A01 CSCL 08G

Three spectral models defining the spatial distribution of soil areas by levels of amorphous iron, organic carbon, and the ratio of amorphous iron to organic carbon were developed and field verification studies were conducted. The models used particular Thematic Mapper band ratios selected by statistical correlation with soil chemical data. The ability of the models to indicate erosion severity and to differentiate between iron enriched and carbonate paleosols is discussed. In addition, the effect of vegetation cover on paleosols is addressed. M.G.

N87-28196# National Oceanic and Atmospheric Administration, Boulder, Colo.
CATALOG OF SUBMARINE VOLCANOES AND HYDROLOGICAL PHENOMENA ASSOCIATED WITH VOLCANIC EVENTS, JANUARY 1, 1900 TO DECEMBER 31, 1959
P. Hedervari Oct. 1986 45 p Prepared in cooperation with Georgiana Observatory, Budapest, Hungary
(PB87-183943; SE-42) Avail: NTIS HC A03/MF A01 CSCL 08K

Volume II is the second part of a comprehensive catalog of hydrological phenomena associated with volcanoes. Discussed are phenomena occurring from January 1, 1900 to December 31, 1959. GRA

N87-28197*# Florida State Univ., Tallahassee. Dept. of Meteorology.
INVESTIGATING THE ROLE OF THE LAND SURFACE IN EXPLAINING THE INTERANNUAL VARIATION OF THE NET RADIATION BALANCE OVER THE WESTERN SAHARA AND SUB-SAHARA Semiannual Report, 1 Oct. 1986 - 31 May 1987
Eric A. Smith and Sharon Nicholson Jul. 1987 19 p
(Grant NAG5-849)
(NASA-CR-181183; NAS 1.26:181183) Avail: NTIS HC A02/MF A01 CSCL 04A

The status of the data sets is discussed. Progress was made in both data analysis and modeling areas. The atmospheric and land surface contributions to the net radiation budget over the Sahara-Sahel region is being decoupled. The interannual variability of these two processes was investigated and this variability related to seasonal rainfall fluctuations. A modified Barnes objective analysis scheme was developed which uses an eliptic scan pattern and a 3-pass iteration of the difference fields. For individual titles, see N87-28198 through N87-28198.

N87-28198*# Florida State Univ., Tallahassee. Dept. of Meteorology.
INVESTIGATING THE ROLE OF THE LAND SURFACE IN EXPLAINING THE INTERANNUAL VARIATION OF THE NET RADIATION BALANCE OVER THE NORTHWEST SAHARA AND SUB-SAHARA
Eric A. Smith and Sharon E. Nicholson *In its* Investigating the Role of the Land Surface in Explaining the Interannual Variation of the Net Radiation Balance over the Western Sahara and Sub-Sahara Jul. 1987 5 p (For primary document see N87-28197 22-46)
Avail: NTIS HC A02/MF A01 CSCL 04A

How much of the interannual variation in the satellite derived radiation balance can be purely attributed to changes taking place at the land surface, was examined. The role of surface latent heating was examined in relation to its control of the precipitation pattern from one year to the next. B.G.

N87-28199# Sandia National Labs., Albuquerque, N. Mex.
THEORETICAL DEVELOPMENT FOR THE MAPPING OF MOISTURE FRONTS IN THE HEATED BLOCK EXPERIMENT
J. R. Wayland and D. O. Lee Feb. 1987 50 p
(Contract DE-AC04-76DP-00789)
(DE87-009490; SAND-85-1316) Avail: NTIS HC A03/MF A01

Mathematical expressions are developed for utilization in the analysis of field data. Expressions are given for anomalous zones and for layer earth models bounded on four sides by reflecting planes. The purpose of this document is providing, for those knowledgeable in electromagnetic theory, the necessary background to extend the buried electrode concept to geophysical applications. DOE

N87-28200*# Cornell Univ., Ithaca, N.Y. Dept. of Geological Sciences.
MECHANISMS OF CRUSTAL DEFORMATION IN THE WESTERN US Final Technical Report, 13 May 1983 - 31 Jul. 1986
Donald L. Turcotte Jul. 1986 8 p
(Grant NAG5-319)
(NASA-CR-181230; NAS 1.26:181230) Avail: NTIS HC A02/MF A01 CSCL 08G

The deformation processes in the western United States were studied, considering both deterministic models and random or statistical models. The role of the intracrustal delamination and mechanisms of crustal thinning were also examined. The application of fractal techniques to understand how the crust is deforming was studied in complex regions. Work continued on the development of a fractal based model for deformation in the western United States. Fractal studies were also extended to the study of topography and the geoid. B.G.

N87-28201# Royal Netherlands Meteorological Inst., De Bilt.
ON WAVES IN THE UPPER ATMOSPHERE Thesis - Technische Hogeschool, Eindhoven, The Netherlands

H. Kelder 1986 142 p
(KNMI-WR-86-8; B8700433; ISSN-0169-1651; ETN-87-90167)
Copyright Avail: NTIS HC A07/MF A01

Analytical solutions for the equation describing the vertical propagation of the semidiurnal modes through the mesosphere and lower thermosphere are given. It is possible to calculate the wave function for every height. It is shown that reflection coefficients can be expressed in gamma functions. Using the mean reference atmosphere of CIRA 1972 it is shown that with increasing height the character of the semidiurnal tidal wave gradually shifts to the higher order modes. In the mesosphere, interference by a superposition of tidal modes is important. Dependence on season, latitude, and exospheric temperature is considerable. This sensitivity of the reflection for the temperature profile causes a large variability in tidal structure in the mesosphere and thermosphere. ESA

N87-28202# Technische Hogeschool, Delft (Netherlands).
PROPAGATION OF TRANSIENT ELASTIC WAVES IN STRATIFIED ANISOTROPIC MEDIA Ph.D. Thesis
Joseph Henricus Mari vanderHijden (Schlumberger-Doll Research, Ridgefield, Conn.) 1987 328 p Sponsored by Schlumberger-Doll Research
(ETN-87-90234) Avail: NTIS HC A15/MF A01

Using a modified version of the Cagniard-de Hoop method, an expression for the wave field due to an impulsive point source in a stratified anisotropic medium is derived. Numerical results illustrate the different waveform features that result in a vertically polarized, shear, compressional geometry. The numerical evaluation of the expressions requires less computation time than by evaluating the standard Fourier inversion integrals in the frequency-wavenumber integration method, especially for a not too-large time window. The radiated wave field is computed as an appropriate superposition of generalized-ray constituents. ESA

N87-28203# Technische Hogeschool, Eindhoven (Netherlands).
ON WAVES IN THE UPPER ATMOSPHERE Ph.D. Thesis
Hendrikus Kelder 1987 144 p
(ETN-87-90244) Avail: NTIS HC A07/MF A01

Internal gravity waves, atmospheric tides, and HF electromagnetic waves are discussed. A way to obtain information about the distribution of the electron density from the signals of beacon satellites and radioastronomical observations is described. The characteristics of measured ionospheric irregularities are treated. The propagation of gravity waves in a height-dependent windfield is considered. The influence of the rotation of the Earth on the propagation of gravity waves in wind shears is shown. The propagation of atmospheric tides in a nonisothermal atmosphere is analyzed. Variations in the temperature of the upper atmosphere seems to cause considerable changes in the vertical propagation of tides. ESA

N87-28204# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SEASONAL VARIATIONS OF TROPOSPHERIC OZONE AT NATAL, BRAZIL
J. A. Logan (Harvard Univ., Cambridge, Mass.) and Volker W. J. H. Kirchhoff Jul. 1987 9 p Previously announced in IAA as A86-46483 Submitted for publication
(Contract FINEP-537/CT)
(INPE-4228-PRE/1103) Avail: NTIS HC A02/MF A01

An analysis of ozone measurements from Natal, Brazil (6 deg S, 35 W), with a focus on the seasonal behavior in the troposphere, is presented. Concentrations of ozone in the middle troposphere in the southern spring are unexpectantly high, 60 to 70 ppb, similar to values found at northern midlatitudes in summer, and larger by 20 to 30 ppb than values found at Panama and at southern midlatitudes. It is suggested that photochemical production of ozone associated with emissions of CO, hydrocarbons, and NO(x) from biomass burning may contribute significantly to the high values of ozone. Stratospheric intrusions could also play a role. Data available at present do not permit a definitive evaluation of the relative importance of these two sources of ozone. Data from Natal, in combination with recent aircraft and surface data, show that tropical ozone exhibits strong spatial and temporal inhomogeneities. Author

N87-28205# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THERMOSPHERIC WINDS AND TEMPERATURES OBSERVED BY OI 6300 ANGSTROM EMISSION AT SAO JOSE DOS CAMPOS, BRAZIL, DURING THE SECOND SUNDIAL CAMPAIGN
Y. Sahai, H. Takahashi, N. R. Teixeira, and R. G. Roble (National Center for Atmospheric Research, Boulder, Colo.) Apr. 1987 15 p Presented at the 3rd SUNDIAL Workshop, La Jolla, Calif., 24-28 Feb. 1987
(Contract FINEP-537/CT)
(INPE-4148-PRE/1055) Avail: NTIS HC A02/MF A01

Thermospheric neutral wind and temperature observations measuring OI 6300 angstroms Doppler shift and broadening by means of a Fabry-Perot interferometer were carried out at Sao Jose dos Campos (23.2 deg S, 45.9 deg W), Brazil, during the period September 30 to October 6, 1986. This period of observations included the second SUNDIAL campaign. Here, results are presented and compared with the Thermospheric Global Circulation Model (TGCM) predictions for equinox conditions during solar minimum for this station. Author

N87-28206# Naval Observatory, Washington, D.C.
COMPUTER PROGRAMS FOR SUN AND MOON ILLUMINANCE WITH CONTINGENT TABLES AND DIAGRAMS
P. M. Janiczek and J. A. DeYoung 19 Feb. 1987 132 p
(AD-A182110; NOBS-CIRC-171) Avail: NTIS HC A07/MF A01 CSCL 03A

There is an ever increasing need for quantitative information concerning everyday astronomical events as they affect the range of private, civil and military activities. The information most needed is usually one or a combination of the following: (1) rise and set times of the Sun and Moon, (2) beginning and ending times of twilight, (3) total number of daylight hours, (4) maximum height of the Sun or Moon above the horizon with corresponding time of occurrence, (5) at specific instants, the angular distance of the Sun or Moon from the horizon and from a cardinal direction, (6) the amount of natural light at a designated time of day or night. Despite the calculational complexities implied, it is possible not only to satisfy the needs for all such data in a straightforward way, but also to place appropriate tools for producing the data directly in the hands of those who need it. This publication is intended for a large number of people who have requirements for the type of data listed, but whose education has placed no special emphasis on astronomy. In what follows there are the means for calculating the needed information either by one of the self-contained computer routines provided, or by use of tables, diagrams (also included) and simple arithmetic. GRA

N87-28207# Texas Univ., Dallas. Richardson Center for Space Sciences.
A COLLABORATIVE STUDY OF PLASMA IRREGULARITIES FROM THE HILAT SATELLITE Final Technical Report, 1 Aug. 1983 - 31 Jul. 1986
R. A. Heelis Jan. 1987 24 p
(Contract F19628-83-K-0039)
(AD-A182597; AFGL-TR-87-0036) Avail: NTIS HC A02/MF A01 CSCL 04A

Convective motion and evolution of high latitude plasma irregularities are described. Data is utilized from the retarding potential analyzer and the ion drift meter on board the HILAT satellite to determine the large scale convective motion of the plasma. To obtain this information it is necessary to recover the satellite attitude data so that corrections for the look angle of the sensor with respect to the satellite can be made. The properties of the satellite attitude variation are described and the procedures for reducing the instrument data to geophysical parameters are outlined. Data from successive overlapping contacts of the satellite from three high latitude stations are utilized to provide coverage of the entire high latitude region. Then derivation of the electrostatic

potential distribution is used to describe the global convection pattern. The details of this pattern and its effect on the transport of irregularities from their source region to other locations is studied. GRA

N87-28208*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
KINEMATICS AT THE INTERSECTION OF THE GARLOCK AND DEATH VALLEY FAULT ZONES, CALIFORNIA: INTEGRATION OF TM DATA AND FIELD STUDIES. LANDSAT TM INVESTIGATION PROPOSAL TM-019 Progress Report, 15 Jan. - 15 Aug. 1987
Michael Abrams and Ken Verosub (California Univ., Davis.) 1987 13 p Sponsored by NASA, Goddard Space Flight Center, Greenbelt, Md.
(NASA-CR-180666; NAS 1.26:180666) Avail: NTIS HC A02/MF A01 CSCL 08G

Processing and interpretation of Thematic Mapper (TM) data, extensive field work, and processing of SPOT data were continued. Results of these analyses led to the testing and rejecting of several of the geologic/tectonic hypotheses concerning the continuation of the Garlock Fault Zone (GFZ). It was determined that the Death Valley Fault Zone (DVFZ) is the major through-going feature, extending at least 60 km SW of the Avawatz Mountains. Two 5 km wide fault zones were identified and characterized in the Soda and Bristol Mountains, forming a continuous zone of NW trending faulting. Geophysical measurements indicate a buried connection between the Avawatz and the Soda Mountains Fault Zone. Future work will involve continued field work and mapping at key locations, further analyses of TM data, and conclusion of the project. B.G.

N87-28209# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Ministeria de Ciencia e Tecnologia.
GEOMAGNETIC AND GEOELECTRIC PULSATIONS RECORDED AT THE STATION COMMANDANTE FERRAZ, ANTARCTICA [MICROPULSACOES GEOMAGNETICAS E GEOELETRICAS NA ESTACAO ANTARTICA COMANDANTE FERRAZ]
N. B. Trivedi, A. L. Padilha, and J. M. daCosta Jul. 1987 14 p In PORTUGUESE; ENGLISH summary Presented at the 39th Annual Meeting of the SBPC, Brazil DF, Jul. 1987
(Contract FINEP-537/CT)
(INPE-4237-PRE/1112) Avail: NTIS HC A02/MF A01

Geomagnetic and geoelectric pulsations in the range from 10 to 500 seconds are recorded at the Brazilian station Commandante Ferraz in the Antarctic Peninsula. The characteristics of the PC3 and PC4 micropulsations are studied and discussed in terms of hydromagnetic waves generated at the sunward side of the Earth's magnetosphere. Besides, the same measurements are utilized to obtain a local conductivity profile of the Earth's crust and upper mantle at the station region using principles of electromagnetic induction. Author

N87-28210# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE INFLUENCE OF AN INTERHEMISPHERIC PLASMA FLOW ON THE NEUTRAL ATMOSPHERE BEHAVIOR: I ION-DRAG EFFECTS
Carlos Jose Zamlutti 23 Apr. 1987 16 p Submitted for publication
(Contract FINEP-537/CT)
(INPE-4156-PRE/1060) Avail: NTIS HC A02/MF A01

During solstices a plasma pressure difference exists between geomagnetic conjugated points located in the topside ionosphere. This difference is responsible for an interhemispheric plasma flow. The possibility that this interhemispheric plasma flow can drag along neutral particles and influence the neutral winds is investigated. Author

N87-28211# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SOLAR CYCLE AND SEASONAL VARIATIONS OF THE LOW LATITUDE OI 6300ANGSTROM NIGHTGLOW
Y. Sahai, H. Takahashi, J. A. Bittencourt, J. H. A. Sobral, and N. R. Teixeira Feb. 1987 16 p Submitted for publication
(Contract FINEP-537/CT)
(INPE-4121-PRE/1040) Avail: NTIS HC A02/MF A01

Regular zenith measurements of the OI 6300Angstrom nightglow emission have been carried out at Cachoeira Paulista (22.7 deg S, 45.0 deg W; geomag. 11.9 deg S), Brazil, since 1975. The long series of the observations during the period 1975 to 1982, including the ascending phase of the last solar cycle, permitted studies of solar cycle effects and seasonal variations. A large intensity increase, about seven times, from low to high solar activity has been observed. Also, the seasonal-nocturnal intensity variations show large changes between years of low and high solar activity. The characteristics of the variations observed are closely related to the equatorial electric field variations, since the observation site is under the southern equatorial ionospheric anomaly crest. Author

N87-28212# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SOLAR AND MAGNETIC DECLINATION CONTROL ON THE ELECTROJET AND DISTRIBUTED CURRENTS IN THE IONOSPHERE OVER JICAMARCA
P. Muralikrishna and M. A. Abdu Jul. 1987 26 p Submitted for publication
(Contract FINEP-537/CT)
(INPE-4212-PRE/1093) Avail: NTIS HC A03/MF A01

Daytime variation in the average east-west drift velocity of electrons in the height range of 95 to 110 km over Jicamarca (0.9 deg N, dip latitude), Peru, estimated from VHF radar measurements, is compared with variation in the horizontal component of the geomagnetic field at the closeby Huancayo station (0.6 deg N, dip latitude). On magnetically quiet days, the ratio of delta H to the electron drift velocity shows a local time variation asymmetric with respect to local noon, though one would expect a symmetric cos X (where X is the solar zenith angle) type of variation for the same, if indeed delta H arises solely from the electrojet region in which the electron drift velocities are measured. The observed asymmetry indicates significant contribution of distributed currents from height regions above the electrojet in the integrated current represented by delta H. Further, the observed seasonal variation in the degree of the asymmetry seems to point out the importance of magnetic and solar declination angles in controlling the relative contributions of the distributed (and electrojet) currents to the magnitude of the observed delta H values. Author

N87-28213# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
MAGNETOTELLURIC AND AUDIOMAGNETOTELLURIC MEASUREMENTS AT TWO STATIONS IN THE TAUBATE BASIN [MEDIDAS MAGNETOTELURICAS E AUDIOMAGNETOTELURICAS EM DUAS ESTACOES NA BACIA DE TAUBATE]
N. B. Trivedi, J. M. daCosta, A. L. Padilha, A. Dupis, and C. Cavoit Jul. 1987 18 p In PORTUGUESE; ENGLISH summary Prepared for presentation at the 2nd Regional Meeting of Geophysics, Salvador-BA, 25-27 Nov. 1987
(INPE-4235-PRE/1110) Avail: NTIS HC A02/MF A01

Magnetotelluric (MT) soundings, in the frequency range 0.1 to 5 Hz, and audiomagnetotelluric (AMT) soundings, in the range 4.1 to 2300 Hz, were conducted at Cacapava (45 deg 48 min W, 23 deg 06 min S) and Pindamonhangaba (45 deg 25 min W, 22 deg 53 min S), two stations situated in the Taubate Basin of the Paraiba Rift Valley. This study was intended to identify the existence of possible anomalous conducting layers at depths of a few tens of kilometers, a characterizing factor observed in the principle rifts of the world. The results obtained at these two stations permitted us to estimate the local thickness of the first conducting layer due to sedimentary rocks of the Taubate Group. The sedimentary conducting layer reached the depth of about 120 meters at Cacapava and about 500 meters at Pindamonhangaba. No other conducting layers were observed at crustal depths. Author

N87-28214# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ANALYSIS OF IONOSPHERIC F REGION LOW LATITUDE MAGNETIC PERTURBATIONS [ANALISE DA REGIAO F IONOSFERICA DE BAIXA LATITUDE MAGNETICAMENTE PERTURBADA]
E. R. dePaula, M. A. Abdu, and J. A. Bittencourt 3 Apr. 1987 29 p In PORTUGUESE; ENGLISH summary Presented at the 14th Scientific Conference of Geophysics and Geodesy, Mendoza, Argentina, 27-31 Oct. 1986
(INPE-4127-PRE/1042) Avail: NTIS HC A03/MF A01

The ionospheric F region behavior, during magnetic storms, was analyzed using the parameters f0F2 and hpF2 reduced from ionograms of Cachoeira Paulista and Fortaleza. It was observed that at Fortaleza increases of f0F2 (positive phase), relative to quiet periods, during all phases of a storm, are more frequent. At Cachoeira Paulista, a positive phase in f0F2 during the main phase of the storm, was observed in many storms followed by a decrease in f0F2 (negative phase) during the recovery phase of the storm. Also great fluctuations on f0F2 and hpF2, of short periods of time, were observed, evidencing a penetration at low latitudes of magnetospheric electric fields during magnetic storms. A numerical model of the ionosphere that calculates theoretically the profile of O+, at low latitudes, was developed, using as parametric entry models the meridional neutral wind, the equatorial vertical drift, and the neutral atmosphere. A careful analysis of the effects of these entry models, adequately chosen to represent magnetically disturbed conditions, on the calculated values of f0F2 and hmF2, was done. Using this ionospheric model it was established that the vertical drift and the neutral wind are the main factors causing f0F2 positive phase during the main phase of the storm. The negative phase in f0F2 are explained by changes in the thermospheric composition. Author

N87-28215# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
CLARIFICATION OF THE IONOSPHERIC F REGION MAGNETIC STORMS IN LOW LATITUDES IN BRAZIL Ph.D. Thesis - 23 Jun. 1986 [RESPOSTA DA REGIAO F IONOSFERICA AS TEMPESTADES MAGNETICAS EM BAIXAS LATITUDES NO BRASIL]
Eurico RodriguesdePaula [1987] 205 p In PORTUGUESE; ENGLISH summary
(INPE-4106-TDL/259) Avail: NTIS HC A10/MF A01

The ionospheric F region behavior, during magnetic storms, was analyzed using the parameters f0F2 and hpF2 reduced from ionograms of Cachoeira Paulista and Fortaleza. Polarimeters and photometer data were also used in the analysis. A numerical model of the ionosphere was developed, which calculates theoretically the profile of the ion O+, at low latitudes, using as parametric entry models the meridional neutral wind, the equatorial vertical drift, and the neutral atmosphere. An analysis of the effects of these entry models, adequately chosen to represent magnetically disturbed conditions, on the calculated values of f0F2 and hmF2, was done. Using this model it was established that the vertical drift and the neutral wind are the main factors causing the f0F2 positive phase during the main phase of a storm. The negative phases of f0F2 are explained by changes in the thermospheric composition. Author

N87-28074# Joint Publications Research Service, Arlington, Va.
DISTRIBUTION OF ATMOSPHERIC METHANE CONCENTRATION OVER DIFFERENT TECTONIC REGIONS Abstract Only
Ye. V. Stadnik, I. Ya. Sklyarenko, I. S. Guliyev, and A. A. Feyzullayev *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 1 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 289, no. 3, Jul. 1986 p 703-705 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

N87-28089# Joint Publications Research Service, Arlington, Va.
SOLUTION OF DIRECT GRAVIMETRIC AND MAGNETOMETRIC PROBLEMS ON BASIS OF NEW ANALYTICAL REPRESENTATIONS FOR ELEMENTS OF FIELDS FROM STANDARD APPROXIMATING BODIES Abstract Only
V. N. Strakhov, M. I. Lapina, and A. B. Yefimov *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 60-61 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Zemli (Moscow, USSR), no. 7, Jul. 1986 p 66-78 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

N87-28090# Joint Publications Research Service, Arlington, Va.
PROSPECTS FOR DEVELOPING GRAVITATIONAL GRADIOMETER FOR MOVING BASE Abstract Only
I. I. Kalinnikov *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 61 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Zemli (Moscow, USSR), no. 7, Jul. 1986 p 105-111 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

N87-28091# Joint Publications Research Service, Arlington, Va.
MECHANISM OF FORMATION OF EARTH'S CONTINENTAL CRUST Abstract Only
O. A. Bogatikov and A. A. Tsvetkov *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 64 Transl. into ENGLISH from Vestnik Akademii Nauk SSSR (Moscow, USSR), no. 6, Jun. 1986 p 71-82 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

N87-28096# Joint Publications Research Service, Arlington, Va.
SEMINAR ON MATHEMATICAL MODELING OF GEOPHYSICAL CURRENTS Abstract Only
V. A. Ryabchenko *In its* USSR Report: Earth Sciences 9 Jul. 1987 p 11 Transl. into ENGLISH from Okeanologiya (Moscow, USSR), v. 26, no. 6, Nov. - Dec. 1986 p 1040-1044 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

N87-28102# Joint Publications Research Service, Arlington, Va.
DISCOVERY OF HELIUM THE SAME AGE AS THE PLANET CONTRIBUTES TO VOLCANOLOGY Abstract Only
In its USSR Report: Earth Sciences 9 Jul. 1987 p 39 Transl. into ENGLISH from Tass (Leningrad, USSR), 20 Dec. 1986 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

N87-28103# Joint Publications Research Service, Arlington, Va.
SEISMIC FOCUS IS KEY TO SEISMIC DANGER PROBLEM
Nikolai Shebalin *In its* USSR Report: Earth Sciences 9 Jul. 1987 p 42-45 Transl. into ENGLISH from Novosti Nauki i Tekhniki (Moscow, USSR), no. 15, 3 Oct. 1986 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

N87-28104# Joint Publications Research Service, Arlington, Va.
FORECASTERS OF EARTHQUAKES
Lyudmila Maximova *In its* USSR Report: Earth Sciences 9 Jul. 1987 p 53-55 Transl. into ENGLISH from Novosti Nauki i Tekhniki (Moscow, USSR), no. 23(106), 5 Dec. 1986 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

N87-28105# Joint Publications Research Service, Arlington, Va.
SOLITON PROPERTIES OF TELESEISMIC WAVES Abstract Only
N. G. Gamburtseva, A. V. Nikolayev, O. B. Khavroshkin, and V. V. Tsyplakov *In its* USSR Report: Earth Sciences 9 Jul. 1987 p 85 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 291, no. 4, Dec. 1986 p 814-816 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

N87-28106# Joint Publications Research Service, Arlington, Va.
DETERMINING ATMOSPHERIC TEMPERATURE AND PRESSURE PROFILES FROM MEASUREMENTS OF ASTRONOMICAL REFRACTION NEAR HORIZON Abstract Only
N. A. Vasilenko, K. P. Gaykovich, and M. I. Sumin *In its* USSR Report: Earth Sciences 9 Jul. 1987 p 98 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Atmosfery i Okeana (Moscow, USSR), v. 22, no. 10, Oct. 1986 p 1026-1033 Original language document was announced in IAA as A87-25190 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

N87-28107# Joint Publications Research Service, Arlington, Va.
OZONE HOLE OVER THE ANTARCTIC Abstract Only
In its USSR Report: Earth Sciences 9 Jul. 1987 p 100 Transl. into ENGLISH from Tass (Moscow, USSR), 23 Jan. 1987 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

N87-28120# Institut fuer Allgemeine und Angewandte Geophysik, Munich (West Germany).
REQUIREMENTS ON RADAR DATA FOR GEOLOGICAL APPLICATION: A CASE STUDY BY USE OF MULTISTAGE DATA OF THE TESTSITE SARDEGNA/ITALY
F. Jaskolla and M. Rast (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands) *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 29-34 (For primary document see N87-28115 22-43)
Copyright Avail: NTIS HC A14/MF A01

N87-28121# Geological Survey of the Netherlands, Enschede.
SPOT: HOW GOOD FOR GEOLOGY? A COMPARISON WITH LANDSAT MSS
A. Sesoeren *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 35-39 (For primary document see N87-28115 22-43)
Copyright Avail: NTIS HC A14/MF A01

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N87-28216*# Control Data Corp., Minneapolis, Minn. Research and Advanced Design Lab.
DYNAMIC CHARACTERISTICS OF OBSERVED SUDDEN WARMINGS Final Report, May 1983 - May 1986
D. G. Dartt and D. E. Venne Sep. 1986 125 p
(Contract NASw-3761)
(NASA-CR-180358; NAS 1.26:180358) Avail: NTIS HC A06/MF A01 CSCL 04B

The planetary wave dynamics of stratospheric sudden warmings in the Northern Hemisphere for a large number of observed events that occurred during winters from 1970 to 1975 and 1978 to 1981 are investigated. The analysis describes wave propagation and zonal flow interaction from the troposphere upwards to near 50 km, and in some years to near 80 km. Three primary topics are covered here: (1) the interaction of zonally propagating and quasi-stationary planetary waves during warming events; (2) planetary wave influence on zonal flow near the stratopause; and (3) planetary wave propagation to near 80 km as seen from Stratospheric and Mesospheric Sounder (SAMS) data. Author

N87-28217# East Anglia Univ., Norwich (England). Climatic Research Unit.
A DATA BANK OF ANTARCTIC SURFACE TEMPERATURE AND PRESSURE DATA
P. D. Jones and D. W. S. Limbert Jun. 1987 57 p Prepared in cooperation with British Antarctic Survey, Cambridge, England
(Contract DE-FG02-86ER-60397)
(DE87-010689; DOE/ER-60397/H2) Avail: NTIS HC A04/MF A01

A data bank of monthly-mean surface air temperature and sea-level or station-level pressures is presented for 29 stations over the Antarctic region south of 60°S. Considerable attempts have been made to locate missing data in nationally published sources and in World Weather Records. By cross-checking neighboring station data, suspect values have been either verified or corrected. At four sites in the Antarctic Peninsula region, composite records were produced by amalgamating records from a number of short and longer length records at or near the key sites. The four sites were Bellingshausen, Faraday, Esperenza and Rothera. The mean Antarctic temperature series produced by Raper et al. (1984) is updated using the same method of calculation.
DOE

N87-28218# European Space Agency, Paris (France).
THREE DFVLR POWERED GLIDERS. A METEOROLOGICAL MEASURMENT SYSTEM FOR THE INVESTIGATION OF THE ATMOSPHERIC BOUNDARY LAYER
Anne M. Jochum, Manfred Reinhardt, E., and Hermann Willeke Jan. 1987 162 p Transl. into ENGLISH of Die drei Motorsegler der DFVLR. Ein Meteorologisches Messystem zur Untersuchung der Atmosphaerischen Grenzschicht (Oberpfaffenhofen, West Germany, DFVLR), Nov. 1986 Original language document was announced as N85-27862
(ESA-TT-920; DFVLR-FB-84-50; ETN-87-90004) Avail: NTIS HC A08/MF A01; original German version available from DFVLR, Cologne, West Germany DM 45.50

Three ASK 16 powered gliders were used as meteorological research aircraft for atmospheric boundary layer studies. The instrumentation and the data acquisition and evaluation systems as well as error analysis are described. Data and results are presented.
ESA

N87-28219# National Weather Service, Honolulu, Hawaii.
TROPICAL CYCLONES, 1986: CENTRAL NORTH PACIFIC
W. Au, A. Chun, H. Rosendal, and R. Sewake Apr. 1987 44 p
(PB87-187209; NOAA-TM-NWSTM-PR-32) Avail: NTIS HC A03/MF A01 CSCL 04B

Listings and patterns of tropical cyclones in the Central North Pacific area are given for 1986.
GRA

N87-28220# National Weather Service, Garden City, N.Y.
AVGPLOT AND AVGCLIM
A. Blackburn May 1987 35 p
(PB87-180626; NOAA-NWS-ERCP-40) Avail: NTIS HC A03/MF A01 CSCL 04B

AVGPLOT and AVGCLIM manipulate monthly data by computing and plotting running averages, grouping them by months, and correlating above and below average months. These programs were written to recreate an earlier study of conditional probabilities done at Buffalo, N.Y. The several moves and instrument changes at Buffalo required finding which moves affected normals, and finding a better way to determine normals and which years were above and below normal. AVGPLOT plots running averages on an AFOS-displayable graphic. AVGCLIM compares different groups of monthly data to show correlations between above and below normal.
GRA

N87-28221# National Climate Program Office, Rockville, Md.
NATIONAL CLIMATE PROGRAM Annual Report, 1985
Jan. 1987 50 p
(PB87-190518) Avail: NTIS HC A03/MF A01 CSCL 04B

African rainfall monitored; drought detection techniques used to assess African crop condition; World Agriculture Outlook Board monitors African crops; climate assessment technology developed for less-developed countries. U.S. heating bills estimated from monthly temperatures, data handling modernized and user serviced expanded; agribusiness use of climate data evaluated; second volume of climate data catalog published; climate products available; scope of satellite products increased; and regional climate centers and states test climate delivery systems are examined.
GRA

N87-28222# National Oceanographic Data Center, Washington, D. C.
MARINERS WEATHER LOG, VOLUME 31, NUMBER 2, SPRING 1987
1987 82 p
(PB87-193769) Avail: NTIS HC A05/MF A01 CSCL 04B

The Mariners Weather Log of Spring 1987 contains articles with the following titles: They two icebergs; Eastern North Pacific Tropical Cyclones of 1986; Central North Pacific Tropical Cyclones (1986); Marine Observation Program; and, Hurricane Alley. GRA

N87-28223# Argonne National Lab., Ill.
CLOUD CHEMISTRY AND CLOUD PHYSICS ORGANIZATION (3CPO): COORDINATION DOCUMENT
D. L. Sisterson, ed. Jun. 1987 103 p
(Contract W-31-109-eng-38)
(DE87-010796; ANL/ER-TM-87-1) Avail: NTIS HC A06/MF A01

This Coordination Document describes plans of an ad hoc committee of atmospheric chemists, physicists and meteorologists for a joint convective storm measurement program to be conducted in east-central Illinois during the summer of 1988. This field program will be a one-time effort, and cooperative participation is encouraged by all interested members of the extended scientific community. Its principal objective to provide a complete description is technically possible of the dynamical, microphysical, and chemical processes occurring within convective storms. Separate abstracts have been prepared for the individual plans. DOE

N87-28224# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
TRANSIENT KINETIC ENERGY AT 200MB AND THE DEVELOPMENT OF SYNOPTIC DISTURBANCES OVER SOUTH AMERICA DURING THE SOUTHERN WINTER
Manoel Alonso Gan and V. B. Rao Jul. 1987 25 p Submitted for publication
(INPE-4216-PRE/1097) Avail: NTIS HC A02/MF A01

The calculation of transient perturbation kinetic energy (TPKE) over South American and Australian sectors showed that it is high in the upper troposphere. A preliminary analysis suggested that these two regions are favorable for internal baroclinic instability. In an attempt to identify synoptic disturbances whose development might be linked to baroclinic instability, a case study of a winter disturbance over South America was undertaken. This showed the intensification of a cyclonic disturbance over the continent. The intensification occurred first in the upper troposphere. The disturbance showed several characteristics of baroclinic disturbances such as the eastward propagation, intensification with westward vertical tilt and barotropic decay. However, the vertical tilt was confined to upper levels only. This suggested that the mechanism of development might be somewhat different compared to the usual baroclinic instability associated with low level vertical inclination. Internal baroclinic instability is a plausible mechanism of development. Author

N87-28225# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
RADON CONCENTRATION INVERSIONS IN THE TROPOSPHERE
Enio Bueno Pereira and Marco Antonio Maring Lemes Jul. 1987 22 p Submitted for publication
(Contract FINEP-537/CT)
(INPE-4197-RPE/544) Avail: NTIS HC A02/MF A01

Vertical concentrations of radon in the lower troposphere were obtained in southern Brazil up to 7 km high and have shown unexpected inverted profiles. The presence of low pressure center systems southwest of the flight path suggested that these inversions might have been originated by a vertical transport mechanism based on the large scale circulation of developing synoptic systems. A simple friction driven circulation model was constructed and the transport equation was solved. The results show that upward motions of 2.5 cm.s-1 can induce the observed inversion. Author

N87-28226# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PREDICTION OF ANNUAL RAINFALL AT FORTALEZA, CE, BRAZIL IN RECENT YEARS
R. P. Kane Apr. 1987 26 p Submitted for publication
(Contract FINEP-537/CT)
(INPE-4160-PRE/1062) Avail: NTIS HC A03/MF A01

Power Spectrum Analysis of Fortaleza annual rainfall data for 1849-1976 indicated periodicities T = 12.9 and 25.1 years significant at a 5 sigma (a priori) level and in addition, T = 2.07, 3.63, 4.84, 5.69, 10.1, 18.0, and 61.0 at a 2 sigma (a priori) level. Using all these, the predicted values for 1977-86 match well with the observed values. In future, a minor drought during 1993-96 and a major drought during 2003-12 are envisaged. However, the above periodicities explain only approximately 62% variance, implying approximately 38% random component. The standard errors for predicted flood and drought rainfalls are sigma = +/- 400 mm and sigma = +/- 300 mm, respectively. Hence, drought intervals could have a few years of normal (or even above-normal) rainfalls. Similarly droughts could occur during expected flood intervals. A transient QBO (T = 2-3 years) could complicate matters further. Author

N87-28227# RAND Corp., Santa Monica, Calif.
NEW WEATHER SENSING AND FORECASTING CAPABILITIES FOR GROUND-TO-SPACE OPERATIONS Interim Report
C. Schutz and F. W. Murray Feb. 1987 49 p
(Contract F49620-86-C-0008)
(AD-A182002; RAND/N-2551-AF) Avail: NTIS HC A03/MF A01 CSCL 04B

Certain weather variables exercise an important control over space operations, either by making a launch infeasible or by adversely affecting the space vehicle and its trajectory. Climatological studies and standard National Weather Service observations show that the normal range of variability with location and season, even from day to day, precludes the forecasting of these variables sufficiently accurately for precise trajectory control. Several new systems are now becoming available for measuring wind and density (or variables from which density can be computed) continuously and automatically: VAS, PROFILER, WINDSAT, and the next generation of weather satellites. Together these systems offer the promise of continuous real-time monitoring of winds and air density throughout that part of the atmosphere that exercises the greatest influence on space operations. GRA

N87-28228# Naval Postgraduate School, Monterey, Calif.
A SYNOPTIC INVESTIGATION OF MARITIME CYCLOGENESIS DURING GALE M.S. Thesis
William E. Pertle Mar. 1987 104 p
(AD-A182085) Avail: NTIS HC A06/MF A01 CSCL 04B

A synoptic diagnosis of two intensive observation periods (IOP 1 and 9) of the Genesis of Atlantic Lows Experiment (GALE) is conducted. Operationally available data and some preliminary GALE data were used to describe key synoptic and subsynoptic features that are important to the coastal and ocean cyclogenesis, and explain the evolution of these features is addressed. A verification of the Navy Operational Regional Analysis and Prediction System (NORAPS) forecasts of these systems is conducted. In both cases mesoscale structure was important in understanding the cyclogenesis event. Cyclogenesis of both IOP 1 and 9 represent more complex interactions and processes than the simplified cyclogenesis suggested by the quasi-geostrophic theory. GRA

N87-28229# National Oceanic and Atmospheric Administration, Norman, Okla. National Severe Storms Lab.
OKLAHOMA DOWNBURSTS AND THEIR ASYMMETRY Final Report
Michael D. Eilts and Richard J. Doviak Nov. 1986 50 p
(Contract DTFA01-80-Y-10524)
(AD-A182097; DOT/FAA/PM-87/7) Avail: NTIS HC A03/MF A01 CSCL 04B

Doppler radar data, collected each spring from 1979 to 1984, with the two Doppler radars operated by the National Severe Storms Laboratory (NSSL), are used to investigate the asymmetry of low-altitude divergent outflows of convective storm downbursts in central Oklahoma. Outflows in Oklahoma storms can be highly asymmetric with horizontal shear along the axis of maximum divergence as much as 5.5 times the shear along the axis of minimum divergence. The downbursts observed in central Oklahoma, all large-scale (4 to 10 km) events, were superposed with the maximum reflectivity core of the storms. However, scanning strategies may have precluded detection of smaller scale (less than 4 km) microbursts. Typical downbursts observed during the Joint Airport Weather Studies (JAWS) Project were of smaller scale (less than 4 km) and were often associated with little or no rain at the surface. The mechanisms for the initiation of the majority of JAWS microbursts was most likely evaporative cooling, which occurred when precipitation fell into a dry, deep and nearly adiabatic boundary layer. It appears that, because of a lower cloud base and a moister and slightly more stable boundary layer, the mechanisms for the initiation of the observed Oklahoma downbursts include low-level melting, as well as evaporation of precipitation, low-level precipitation loading, and evaporational cooling at middle levels due to entrainment of dry hair. GRA

N87-28230# Technion - Israel Inst. of Tech., Haifa. Dept. of Mathematics.

THE STABILITY OF ATMOSPHERIC FIELDS INDUCED BY LOCALIZED TOPOGRAPHY AND HEAT SOURCES Final Report, 1 Mar. 1983 - 28 Feb. 1987

Lee-Or Merkine 31 Mar. 1987 77 p

(Grant AF-AFOSR-0069-83)

(AD-A182228; AFOSR-87-0859TR) Avail: NTIS HC A05/MF A01 CSCL 04B

In slightly viscous rotating stratified systems weak potential vorticity sources can excite finite amplitude response when the group velocity of the long waves vanishes. This mechanism is used, in a two layer fluid, to generate steady state solutions that can be characterized as currents. The currents are strongly sheared in both the vertical and the meridional directions but they vary slowly in the zonal direction. Numerical simulations reveal that the currents are unstable with respect to small perturbations and that the unstable response is dominated by trapped eigenmodes. A WKB analysis jointly with a second order turning point problem are used to derive a consistent description of the spatial and temporal characteristics of the unstable eigenmodes. The stability analysis is applicable to zonally varying basic states that are stationary with respect to zonal variations at some isolated points of the flow domain. GRA

N87-28231# Air Force Geophysics Lab., Hanscom AFB, Mass.

THE IMPACT ON SHORT-TERM PRECIPITATION FORECAST SKILL OF TIME-DEPENDENT LATERAL AND LOWER BOUNDARY CONDITIONS WITHIN A MESO-BETA NUMERICAL CLOUD PREDICTION MODEL

G. Modica Aug. 1987 6 p

(AD-A182864; AFGL-TR-87-0228) Avail: NTIS HC A02/MF A01 CSCL 04A

A meso beta predictive grid point model with a detailed microphysics parameterization of grid scale (20 km) warm cloud processes is briefly described. The model is initialized with a mesoscale data set; 6 h model predicted rainfall amounts are compared with both observed rainfall amounts and predictions from subsequent model runs which include: (1) a surface energy budget, and (2) a time-dependent lateral boundary condition. The results indicate that the time dependent boundary condition has a much more marked effect on both the evolution and the total accumulation of precipitation. GRA

N87-28232*# FWG Associates, Inc., Tullahoma, Tenn.

DEVELOPMENT OF A MICROBURST TURBULENCE MODEL FOR THE JOINT AIRPORT WEATHER STUDIES WIND SHEAR DATA

Ho-Pen Chang and Walter Frost Mar. 1987 79 p

(NASA Order H-59314-B; DTFA01-82-Y-10513)

(NASA-CR-180374; NAS 1.26:180374; DOT/FAA/PM-87/12)

Avail: NTIS HC A05/MF A01 CSCL 04B

A turbulence model is developed to supplement the microburst quasi-steady wind shear model established earlier from the JAWS Doppler radar sets. The wind shear model is, in effect, a quasi-steady, spatially varying wind field. The spatial scale of the wind variation is on the order of 500 to 750 ft. Airborne sensor response (i.e., angle of attack, stall warning, pitot tubes, etc.), structural dynamics, pilot workload, and other such factors, however, respond to much higher frequency wind effects. To account for these effects, a first cut turbulence model based on Doppler radar second moment data is presented. Superimposing the turbulent fluctuation from this turbulence model on the quasi-steady JAWS wind field is believed to provide a more realistic simulation of the microburst flow for aviation application. Author

N87-28233# National Oceanic and Atmospheric Administration, Norman, Okla.

LOW-ALTITUDE WIND SHEAR DETECTION WITH DOPPLER RADAR Final Report

Michael D. Ellis Feb. 1987 41 p

(Contract DTFA01-80-Y-10524)

(AD-A181900; DOT/FAA-PM-87/6) Avail: NTIS HC A03/MF A01 CSCL 04B

The feasibility of using the next generation weather radar (NEXRAD) system to detect low-altitude horizontal wind shear airports is investigated. We compare surface measured horizontal shear with that observed aloft with Doppler radar to determine how the radar-estimated shear above the surface relates to the surface-measured shear. For five Oklahoma gust fronts, the Doppler radar shear (at heights between 50 and 600 m) averaged 1.6 times the shear measured at the surface. For none of the 43 comparisons was the surface radial velocity difference across the gust front stronger than the radial velocity difference measured by the Doppler radar aloft. When the five gust fronts passed an instrumented tower a vertical profile through the lowest 440 m of the gust front could be determined. In all cases the wind speed and wind shear increased in the lowest 90 m of the atmosphere. In one case, the 90 m height had the peak wind shear; in all other cases the peak wind shear was at a much higher altitude. GRA

N87-28234# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

ESTIMATION OF THE PRECIPITATION RATE OF ANTROPOGENIC SO2 IN THE GREATER SAO PAULO REGION [ESTIMATIVA DA TAXA DE PRECIPITACAO DE SO2 ANTROPOGENICO NA GRANDE SAO PAULO]

Clovis MonteirodoEspiritoSanto and Lycia Maria MoreiraNordemann Jul. 1987 18 p In PORTUGUESE; ENGLISH summary Submitted for publication

(INPE-4264-PRE/1137) Avail: NTIS HC A02/MF A01

Using the CETESB data of the SO2 concentration and emission rate over Great Sao Paulo, an annual deposition rate of the pollutant, for this region and its surroundings, was estimated. A pollutant depostion numerical model was used for obtaining these estimates. The model, its application, as well as its inherent limitations, are discussed. Author

N87-28235# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

A SYSTEM FOR DETERMINATION OF WIND FIELDS FROM CLOUD TRACKING [UM SISTEMA PARA A DETERMINACAO DE CAMPOS DE VENTOS A PARTIR DO RASTREIO DE NUVENS]

Eni AlvimdeOliveira May 1987 14 p In PORTUGUESE; ENGLISH summary Submitted for publication

(INPE-4171-PRE/1068) Avail: NTIS HC A02/MF A01

Wind measurement is made possible utilizing a sequence of geostationary meteorological satellite images, covering the same region of the Earth's surface and correctly aligned. This paper describes the basic components of a system for cloud wind

tracking, and discusses the research under development at INPE regarding cloud selection, image preprocessing, and cloud tracking in one or two stages. Author

N87-28236# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
COMPARATIVE STUDY OF THE EFFECTS OF MAGNETIC STORMS WITHIN VLF ON THE MAGNETIC ANOMALIES OF THE SOUTH ATLANTIC M.S. Thesis [ESTUDO COMPARATIVO DOS EFEITOS DE TEMPESTADES MAGNETICAS EM VLF NA ANOMALIA MAGNETICA DO ATLANTICO SUL]
Neusa Maria PaesLeme Dec. 1986 147 p In PORTUGUESE; ENGLISH summary
(INPE-4084-TDL/251) Avail: NTIS HC A07/MF A01

Effects produced in the lower ionosphere by forty magnetic storms were analyzed in the period of 1976 to 1981. Using VLF propagation path omega-Argentina/Atibaia, which is located in the Brazilian Geomagnetic Anomaly. Some storm effects which occurred in 1981 were also analyzed by means of a VLF/LF Oblique Ionosonde operated by CTA/IAE, with the transmitter located in Paula Freitas and the receiver in Gaspar. Comparison between frequencies of 13.6 and 10.2 KHz showed well-defined propagation characteristics. For the frequencies of 10.2 and 13.6 KHz, the height near 80 and 83 km night propagation was obtained, respectively. Differences in electron density and ionization time for each region was verified. Reflectivity data for the Oblique Ionosonde indicated the occurrence of more than one reflection layer of the signal in near heights. The results confirmed the increase of electron density in about 8 to 48 hours after the sudden commencement (sc) onset, and lasting from one to several days. Electron flux calculations revealed the existence of particles with energy ranging from 10 to 200 KeV and flux ranging from J = 1000-1,000,000 electrons/sq cm s for energy between 50 is equal to or less than E sub 0 is equal to or less than 150 KeV for the largest observed phase deviation. The electron density in the region considered changed from 1000 to 10,000 electrons/cu cm during the periods of maximum activity. On the other hand, some magnetic storms have shown a decrease in the electron density near the sc, effect not observed in this region. Author

N87-28093# Joint Publications Research Service, Arlington, Va.
THE GLOBAL MECHANISM OF STORMS Abstract Only
In its USSR Report: Earth Sciences 9 Jul. 1987 p 1 Transl. into ENGLISH from Tass (Leningrad, USSR), 27 Dec. 1986 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

N87-28094# Joint Publications Research Service, Arlington, Va.
WHAT CLIMATE IS TYPICAL FOR THE EARTH Abstract Only
N. M. Chumakov *In its* USSR Report: Earth Sciences 9 Jul. 1987 p 2 Transl. into ENGLISH from Priroda (Moscow, USSR), no. 10, Oct. 1986 p 34-45 Original language document was announced in IAA as A87-29178 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

N87-28095# Joint Publications Research Service, Arlington, Va.
NATURAL AND ANTHROPOGENIC CLIMATIC CHANGES Abstract Only
K. Ya. Kondratyev *In its* USSR Report: Earth Sciences 9 Jul. 1987 p 2 Transl. into ENGLISH from Vestnik Akademii Nauk SSSR (Moscow, USSR), no. 10, Oct. 1986 p 30-39 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

N87-28101# Joint Publications Research Service, Arlington, Va.
EDDY DYNAMICS AND SOUTHERN HEMISPHERE ATMOSPHERIC ENERGETICS AT CLIMATIC SCALES Abstract Only
V. F. Romanov and V. Ye. Lagun *In its* USSR Report: Earth Sciences 9 Jul. 1987 p 36-37 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 291, no. 4, Dec. 1986 p 817-822 Original language document was announced in IAA as A87-29044 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

N87-28122# European Space Agency. European Space Operations Center, Darmstadt (West Germany).
METEOROLOGICAL MONITORING WITH METEOSAT
J. Schmetz and O. Turpeinen *In its* Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 43-48 (For primary document see N87-28115 22-43)
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N87-28124# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
CLOUD DETECTION IN NOAA IMAGES
John Skelmose Jensen *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 53-57 Sponsored by the Commission for Scientific Research in Greenland, and the Danish Space Reseach Committee (For primary document see N87-28115 22-43)
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N87-28126# Institut National de la Recherche Agronomique, Montfavet (France). Station of Bioclimatologie.
ON THE USE OF NOAA-AVHRR DATA IN THE LOWER RHONE VALLEY (FRANCE)
J. P. Lagouarde, S. Clinet, S. Gandia, S. Roy, B. Seguin, A. Vidal, and Y. Kerr (Centre National d'Etudes Spatiales, Toulouse, France) *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 69-74 (For primary document see N87-28115 22-43)
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N87-28151# Valencia Univ. (Spain). Dept. of Thermology.
A MODEL OF THERMAL INERTIA FOR FROST FORECASTING IN AGRICULTURAL AREAS
V. Caselles, M. J. Salom, J. Delegido, and S. Gandia *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 253-257 (For primary document see N87-28115 22-43)
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48 OCEANOGRAPHY

Includes biological, dynamic, and physical oceanography; and marine resources.

For related information see also *43 Earth Resources and Remote Sensing.*

N87-28237# Technische Hogeschool Twente, Enschede (Netherlands).
STORM SURGE PREDICTION USING KALMAN FILTERING Ph.D. Thesis
Arnold Willem Heemink 1986 196 p
(B8700461; ETN-87-90250) Avail: NTIS HC A09/MF A01

Kalman filtering was employed to develop a method for predicting water levels along the Dutch coast. The combination of the standard Kalman filter with a nonlinear tidal model of the entire North Sea was not feasible, so two different approaches were developed. The first is based on the approximation of the tidal movement in the Dutch coastal area by a one-dimensional model. To increase the prediction interval the second approach is based on a two-dimensional model of the entire North Sea. The filter was tested using simulated data as well as field data. The results show excellent filter performance, especially given that the number of measurements was very limited. For the deterministic model without using the water level measurements available, the improvement obtained by filtering these measurements is substantial. ESA

N87-28238# Naval Ocean Research and Development Activity, Bay St. Louis, Miss. Ocean Acoustics Div.
THE OCEAN DATA CSTD MACINTOSH SYSTEM Final Report

Roger W. Meredith and Paul J. Succa Sep. 1986 28 p
(AD-A181499; NORDA-180) Avail: NTIS HC A03/MF A01
CSCL 08C

The Ocean Data Model 302A CSTD oceanographic profiling system is self-recording, preprogramming device. The system was integrated with the Apple MacIntosh computer to yield a portable, durable and easy-to-use system for measuring ocean conductivity, temperature, and salinity as a function of depth, and for calculating accurate sound speed values (roughly + or - 0.2 m/sec) for acoustic and oceanographic analysis and data quality assurance.This system enables the user to tabulate and plot the above values in near real time for field analysis. Little operator training time is required to operate this system, which was used successfully in the northeast Pacific and in the Arctic. The CSTD data output from the Model 302A reader/recorder are stored on MacIntosh 3.5 inch hard-shelled floppy discs and processed using Microsoft Corporation's program EXCEL. A description of the system, specifications, and user's guide are included, as well as a listing of the routines and samples of the outputs. GRA

N87-28239# Woods Hole Oceanographic Institution, Mass.
DATA TELEMETRY, ASSIMILATION AND OCEAN MODELING Semiannual Report, 1 Oct. 1986 - 1 Apr. 1987
Daniel E. Frye Jun. 1987 41 p
(Contract N00014-86-K-0751)
(AD-A181899; WHOI-87-21) Avail: NTIS HC A03/MF A01
CSCL 08C

The objectives of this program are to advance the state of the art in ocean data telemetry, interpretation of remotely sensed data from satellite, and numerical modeling of ocean circulation. Ocean data telemetry is being addressed by several development projects whose aim is to reliably transfer data from in situ oceanographic instruments to laboratory computers on the shore. The satellite oceanography group is developing expertise in analyzing, manipulating, displaying and archiving data from all of the major satellite oceanographic sensors. The numerical modeling initiative is working on a family of circulation models which can be connected at their boundaries to cover the important mesoscale and basin wide flow regimes. These ambitious plans are intended to bring new technologies developed in the communications, electronics, satellite sensing and computer science fields into everyday use in oceanography so that they can be ready for the global science programs planned for the 1990's. GRA

N87-28240# Naval Postgraduate School, Monterey, Calif.
IMPORTANCE OF ROTATION SHEAR STRESS FOR ENTRAINMENT IN THE OCEAN MIXED LAYER Ph.D. Thesis
Patrick C. Gallacher Jun. 1987 143 p
(AD-A181991) Avail: NTIS HC A07/MF A01 CSCL 08C

The interaction of the northward component of planetary rotation and the east-west Reynolds stress affects the isotropy of the integral scale turbulence in the upper ocean by redistributing turbulent kinetic energy (TKE) among the components. This rotation stress mechanism is incorporated into a vertically integrated model of the ocean mixed layer. Simulations of Ocean Weather Stations P (50 N, 145 W) and N (30 N, 140 W) are used to compare this model with the Garwood (1977) model and with observations. The significant effect is the augmentation (for easterly winds) or reduction (for westerly winds) of the ratio of vertical to horizontal TKE. The rate of entrainment is affected by the change in the vertical convergence of TKE at the interface between the mixed layer and the pycnocline. Rotation stress significantly alters the mixing on diurnal to synoptic time scales during late winter and early spring. With rotation stress, retreat is 10-30% greater than without rotation stress. Typically, the ratio of vertical to total TKE is three times larger when rotation stress is included and the dissipation enhancement of Garwood (1977) is neglected. The resulting TKE distribution is more isotropic and in better agreement with laboratory results for neutrally stratified shear flows. This study demonstrates the need for measurements of the TKE budget in the upper ocean to confirm these findings and to further test the hypotheses of TKE models in oceanic applications. GRA

N87-28241# Royal Australian Navy Research Lab., Edgecliff.
DIRECTLY MEASURED CURRENT PROFILES IN THE EAST AUSTRALIAN CURRENT
P. J. Mulhearn Jan. 1987 24 p
(AD-A182233; RANRL-TM-1/87) Avail: NTIS HC A02/MF A01
CSCL 08C

A number of direct measurement of current profiles in the East Australian Current are presented. They were obtained by profiling current meters from a drifting ship. The velocity shear in the current meter results is considerably larger than that calculated by the geostrophic method. GRA

N87-28242# Naval Postgraduate School, Monterey, Calif.
COMPARISON OF SATELLITE-DERIVED OCEAN VELOCITIES WITH OBSERVATIONS IN THE CALIFORNIA COASTAL REGION M.S. Thesis
John F. OHara Mar. 1987 42 p
(AD-A182291) Avail: NTIS HC A03/MF A01 CSCL 08C

Satellite derived ocean surface velocity vectors in the California Current System (CCS) are compared with in situ hydrographic and Doppler data. The in situ data were acquired during the April 1981 phase of the Coastal Ocean Dynamics Experiment (CODE) experiment. In general, the satellite derived velocities agreed with the in situ data. Due to the baroclinic nature of the study region, the satellite vectors were found to be representative of the subsurface geostrophic flow. Although the number and concentration of the satellite vectors was small, these vectors were capable of resolving the mesoscale features located in the study region. Comparison of collocated data revealed that the in situ Doppler velocity measurements were approximately 1.5 times larger than the satellite derived velocity vectors. These results agree with a similar study conducted in an offshore region. GRA

N87-28243# Woods Hole Oceanographic Institution, Mass.
THE ENTRAINMENT AND HOMOGENIZATION OF TRACERS WITHIN THE CYCLONIC GULF STREAM RECIRCULATION GYRE Ph.D. Thesis
Robert S. Pickart May 1987 218 p Prepared in cooperation with Massachusetts Inst. of Tech., Cambridge
(Contracts N00014-76-C-0197; N00014-82-C-0019; N00014-85-C-0001; Grant NSF OCE-82-14925)
(AD-A182341; AD-E900694; WHOI-87-9) Avail: NTIS HC A10/MF A01 CSCL 08C

The distributions of tracer associated with the Northern Recirculation Gyre of the Gulf Stream (NRG) are studied to try to obtain information about the flow. An advective-diffusive numerical model is used whose streamlines consist of a gyre situated alongside a boundary current which inputs tracer into the domain. This is meant to simulate the lateral transfer of properties from the Deep Western Boundary Current (DWBC) to the NRG. Tracer is entrained into the model gyre as a plume which spirals across the streamlines, the characteristics of which depend on the flow parameters. Homogenization occurs at steady state, consistent with recently collected tracer data. The presence of vertical mixing is considered in an attempt to explain a difference between salinity and oxygen observed in the data. Comparison of the model results to the oxygen data is favorable, and leads to an estimate of the lateral and vertical diffusivity. The time dependent nature of freon is addressed using a coupled model of the deep water overflow process, advection-mixing in the DWBC, and subsequent entrainment into the NRG. GRA

N87-28076# Joint Publications Research Service, Arlington, Va.
EDDY-RESOLVING MODEL OF NORTH ATLANTIC CURRENTS Abstract Only.
D. G. Seidov, A. D. Marushkevich, and D. A. Nechayev *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 11-12 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 289, no. 4, Aug. 1986 p 980-983 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

N87-28077# Joint Publications Research Service, Arlington, Va.
MORPHOMETRIC STUDIES OF WORLD OCEAN Abstract Only.
K. A. Zvonarev and Ye. G. Kapralov *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 12 Transl. into ENGLISH from Vestnik Leningradskogo Universiteta, Seriya 7: Geologiya, Geografiya (Leningrad, USSR), no. 3, Sep. 1986 p 50-57 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

N87-28078# Joint Publications Research Service, Arlington, Va.
NUMERICAL MODELING OF SEASONAL VARIABILITY OF WORLD OCEAN Abstract Only.
V. I. Klimok, V. P. Kochergin, and G. Fridrikh *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 15 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Atmosfery i Okeana (Moscow, USSR), v. 22, no. 9, Sep. 1986 p 940-947 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

N87-28079# Joint Publications Research Service, Arlington, Va.
ANALYSIS OF SERIES OF CONVECTIVE STEPS IN TEMPERATURE INVERSION IN SEA Abstract Only.
K. N. Fedorov, V. T. Paka, G. R. Gamsakhurdiya, and M. V. Yemelyanov *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 16 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Atmosfery i Okeana (Moscow, USSR), v. 22, no. 9, Sep. 1986 p 969-978 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

N87-28080# Joint Publications Research Service, Arlington, Va.
FAULTS IN NORTHERN PART OF CENTRAL ATLANTIC Abstract Only
A. O. Mazarovich *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 17-18 Transl. into ENGLISH from Geotektonika (Moscow, USSR), no. 5, Sep. - Oct. 1986 p 25-34 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

N87-28081# Joint Publications Research Service, Arlington, Va.
STATE-OF-ART AND PROSPECTS FOR DEVELOPING EQUIPMENT FOR MEASURING HYDROLOGICAL PARAMETERS IN WORLD OCEAN Abstract Only
T. K. Izmailov, A. M. Izmaylov, and F. M. Allakhverdov *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 23 Transl. into ENGLISH from Izmereniya, Kontrol, Avtomatizatsiya (Moscow, USSR), no. 4, Jul. - Aug. 1986 p 3-11 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

N87-28082# Joint Publications Research Service, Arlington, Va.
VISCOUS DRAG OF OCEANIC LITHOSPHERE Abstract Only
V. P. Trubitsyn and A. S. Fradkov *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 24-25 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Zemli (Moscow, USSR), no. 6, Jun. 1986 p 3-16 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

N87-28083# Joint Publications Research Service, Arlington, Va.
GEOLOGICAL AND GEOPHYSICAL COROLLARIES OF OCEANIC LITHOSPHERE SERPENTINIZATION Abstract Only
L. I. Lobkovskiy, V. N. Nikolayevskiy, and A. V. Karakin *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 25-26 Transl. into ENGLISH from Byulleten Moskovskogo Obshchestva Ispytateley Prirody: Otdel Geologicheskiy (Moscow, USSR), v. 61, no. 4, Jul. - Aug. 1986 p 3-12 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

N87-28084# Joint Publications Research Service, Arlington, Va.
DESCRIPTION OF NORTH ATLANTIC BASEMENT Abstract Only
N. Ya. Kunin and S. V. Usenko *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 27 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Zemli (Moscow, USSR), no. 7, Jul. 1986 p 3-15 (For primary document see N87-28073 22-42)
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N87-28086# Joint Publications Research Service, Arlington, Va.
ASSESSMENT OF RATE OF EQUATORIAL UPWELLING IN CENTRAL PACIFIC OCEAN Abstract Only
V. A. Bubnov *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 41 Transl. into ENGLISH from Okeanologiya (Moscow, USSR), v. 26, no. 4, Jul. - Aug. 1986 p 597-602 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

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PECULIARITIES OF PRESENT-DAY STRUCTURE OF SOUTHERN ANTILLES REGION (SOUTH ATLANTIC) Abstract Only
A. G. Ryabukhin *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 45-46 Transl. into ENGLISH from Byulleten Moskovskogo Obshchestva Ispytateley Prirody: Otdel Geologicheskiy (Moscow, USSR), v. 61, no. 5, Sep. - Oct. 1986 p 37-45 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

N87-28088# Joint Publications Research Service, Arlington, Va.
STRATIGRAPHIC ASPECT OF PALEOMAGNETIC STUDIES OF BOTTOM SEDIMENTS IN SEAS AND OCEANS Abstract ONly
A. N. Tretyak, L. I. Vigilyanskaya, and V. P. Dudkin *In its* USSR Report: Earth Sciences 4 Mar. 1987 p 47 Transl. into ENGLISH from Geofizicheskiy Zhurnal (Kiev, USSR), v. 8, no. 5, Sep. - Oct. 1986 p 23-35 (For primary document see N87-28073 22-42)
Avail: NTIS HC A05/MF A01

N87-28097# Joint Publications Research Service, Arlington, Va.
MODELING OF SYNOPTIC VARIABILITY OF LARGE-SCALE OCEAN CIRCULATION (EXEMPLIFIED BY NORTH ATLANTIC) Abstract Only
D. G. Seidov, A. D. Marushkevich, and D. A. Nechayev *In its* USSR Report: Earth Sciences 9 Jul. 1987 p 18-19 Transl. into ENGLISH from Okeanologiya (Moscow, USSR), v. 26, no. 6, Nov. - Dec. 1986 p 885-891 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

N87-28098# Joint Publications Research Service, Arlington, Va.
MEASURING PROBABILISTIC DISTRIBUTION OF SEA SURFACE CURVATURE RADII Abstract Only
I. B. Yesipov, K. A. Naugolnykh, V. N. Nosov, and S. Yu. Pashin *In its* USSR Report: Earth Sciences 9 Jul. 1987 p 27 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Atmosfery i Okeana (Moscow, USSR), v. 22, no. 10, Oct. 1986 p 1115-1117 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

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INFLUENCE OF AEROSOL EXTINCTION AND VARIATIONS OF METEOROLOGICAL PARAMETERS ON ACCURACY IN DETERMINING OCEAN SURFACE TEMPERATURE Abstract Only
S. V. Afonin, A. G. Gendrin, and V. V. Fomin *In its* USSR Report: Earth Sciences 9 Jul. 1987 p 28 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Atmosfery i Okeana (Moscow, USSR), v. 22, no. 10, Oct. 1986 p 1109-1112 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

N87-28100# Joint Publications Research Service, Arlington, Va.
RADIATION REGIME OF GULF STREAM ENERGY ACTIVE REGION DURING WINTER Abstract Only
L. I. Koprova *In its* USSR Report: Earth Sciences 9 Jul.

1987 p 30 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Atmosfery i Okeana (Moscow, USSR), v. 22, no. 10, Oct. 1986 p 1082-1088 (For primary document see N87-28092 22-42)
Avail: NTIS HC A06/MF A01

N87-28125# Dundee Univ. (Scotland). Physics Lab.
SEA SURFACE TEMPERATURES AND THE DETECTION OF OCEAN CIRCULATION PATTERNS AND FRONTS FROM AVHRR IMAGERY
R. A. Vaughan, I. D. Downey (Salford Univ., England), D. Leng, and J. Coker *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 59-67 (For primary document see N87-28115 22-43)
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N87-28132# Institute of Oceanographic Sciences, Wormley (England).
THE DETERMINATION OF SEA-STATE BIAS AND NON-LINEAR WAVE PARAMETERS FROM SATELLITE ALTIMETER DATA
T. H. Guymer and M. A. Srokosz *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 115-120 Sponsored in part by the UK ERS Data Center (For primary document see N87-28115 22-43)
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N87-28133# Joint Research Centre of the European Communities, Ispra (Italy).
MONITORING AND MODELING OF THE ADRIATIC SEA
J. A. deBekkering *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 121-127 (For primary document see N87-28115 22-43)
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N87-28146# Copenhagen Univ. (Denmark). Inst. of Geophysics.
COASTAL ZONE COLOR SCANNER (CZCS) IMAGES AND OCEAN DYNAMICS. APPLICATION TO THE NORTHWEST AFRICAN UPWELLING AREA
L. Nykjaer, L. VanCamp, P. Schlittenhardt (Joint Research Centre of the European Communities, Ispra, Italy), and R. Refk *In* ESA Proceedings or the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 219-223 (For primary document see N87-28115 22-43)
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N87-28148# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
LARGE SCALE SEA ICE STUDIES BASED ON SCANNING MULTICHANNEL MICROWAVE RADIOMETERS (SMMR) DATA
Peter Sloth and Leif Toudal Pedersen *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 235-238 Sponsored by the Danish Space Research, the Commission for Scientific Research in Greenland, and IBM-Denmark (For primary document see N87-28115 22-43)
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N87-28155# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
TRACKING OF ICE FLOES
Peter Randrup Christensen *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 275-279 Sponsored by the Danish Space Research Commitee, the Commission for Scientific in Greenland, and IBM-Denmark (For primary document see N87-28115 22-43)
Copyright Avail: NTIS HC A14/MF A01

N87-28156# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
SEA ICE OBSERVATIONS BY SAR
Henning Skriver *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 281-288 Sponsored by ESA (For primary document see N87-28115 22-43)
Copyright Avail: NTIS HC A14/MF A01

N87-28157# Roskilde Univ. (Denmark).
STUDIES OF TIDAL FLAT ENVIRONMENTS WITH LANDSAT MSS DATA
S. Folving *In* ESA Proceedings of the ESA/EARSeL Europe from Space Symposium Dec. 1986 p 289-293 (For primary document see N87-28115 22-43)
Copyright Avail: NTIS HC A14/MF A01

51 LIFE SCIENCES (GENERAL)

No abstracts in this category.

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

N87-28244# Vistech Consultants, Inc., Dayton, Ohio.
SUPRATHRESHOLD CONTRAST SENSITIVITY VISION TEST CHART Final Report
Arthur Ginsburg 28 Apr. 1987 35 p
(Contract F49620-86-C-0116)
(AD-A181733; AFOSR-87-0711TR) Avail: NTIS HC A03/MF A01 CSCL 06D

Although visual acuity has been the main measure of visual capability for over 125 years for both the military and civilians, it has been shown not to relate well to visual performance. A new measure of visual capability, contrast sensitivity, has been shown to relate to individual differences in visual capability such as target detection in the laboratory, in flight simulators, and in field studies. Contrast sensitivity testing with sine-wave gratings provides a very accurate measure of target detection threshold. However, although threshold measurements are very important in evaluating pilot visual performance, there are many other critical visual tasks performed at suprathreshold contrast levels. Routine measurement of suprathreshold contrast sensitivity has been difficult to accomplish until now, however, due to the expensive, time-consuming, and complex computer-video systems required for testing. To answer this need, Vistech Consultants, Inc. proposed to develop a new suprathreshold contrast sensitivity vision test chart. This chart was to be designed to measure individual differences related to visual performance. The psychophysical procedure of contrast matching was used to measure an individual's suprathreshold contrast perception of sine-wave gratings for appropriate ranges of spatial frequency and contrast. GRA

N87-28245# Arctic Inst. of North America, Arlington, Va.
OPERATION EVEREST 2: EFFECTS OF A SIMULATED ASCENT TO 29,000 FEET ON NUTRITION AND BODY COMPOSITION Final Report, Sep. - Nov. 1985
Madeleine S. Rose, Charles S. Houston, Charles S. Fulco, Geoffrey Coates, and Dawn Carlson 29 May 1987 129 p
(Contract DAMD17-85-C-5306; DA Proj. 3M2-63763-D-819)
(AD-A181855; USARIEM-T-15-87) Avail: NTIS HC A07/MF A01 CSCL 06D

Progressive body weight loss occurs during high mountain expeditions, but whether it is due to hypoxia, inadequate diet, malabsorption, or to the multiple stresses of the harsh environment is unknown. To determine whether hypoxia alone causes such body weight loss, six men were studied during progressive decompression to 240 torr for 40 days in a hypobaric chamber where hypoxia was the major variable. The subjects were provided a platable ad libitum diet that was modified for individual preferences. Complete food consumption data were available for only 38 of the 40 days. Mean caloric intake for 38 days at altitude was 2639 + or - 848 kcal/day (Mean + or - SD). Caloric intake decreased 42.3% from 3136 kcal during the first 7 days of exposure

to altitude to 1789 kcal during the last 3 days at 282 to 240 Torr. During the same time periods the carbohydrate (CHO) intake decreased from 62.1% to 53.2% (p less than 0.001). All subjects lost body weight with a mean loss of 7.44 + or - 2.24 kg (8.90% of the initial body weight). Loss of body weight was greater than could be accounted for by comparing calculated energy expenditures to actual caloric intake. GRA

N87-28246# National Aerospace Medical Centre, Soesterberg (Netherlands).
REPORT OF THE FIRST REGIONAL CIVIL AVIATION MEDICINE SEMINAR
1985 72 p Seminar held in Zeist, The Netherlands, 18-23 Nov. 1985
(ETN-87-90152) Avail: NTIS HC A04/MF A01

The aircraft designer's idea about the flight crew; clinical methods in preventive medicine; developments in antihypertensive therapy in pilots; the value of electrocardiogram examination; cardiac arrhythmia in symptomatic and asymptomatic populations (implications for licensing and follow-up of pilots and air traffic controllers) developments in civil aviation and in ophthalmology, cockpit ergonomics and psychological aspects in aviation; psychosocial stress in commercial aircraft pilots; and aircraft accident analysis were discussed. ESA

N87-28247*# University of Southern Illinois, Carbondale. Dept. of Physiology.
CHARACTERIZATION OF NEUROSPORA CIRCADIAN RHYTHMS IN SPACE Final Technical Report
James S. Ferraro 10 Sep. 1987 14 p
(Grant NAG2-361)
(NASA-CR-181284; NAS 1.26:181284) Avail: NTIS HC A02/MF A01 CSCL 06P

To determine whether the circadian rhythm of conidiation in neurospora crassa is endogenously derived or is driven by some geophysical time cue, an experiment was conducted on space shuttle flight STS-9, where inoculated race tubes were exposed to the microgravity environment of space. The results demonstated that the rhythm can persist in space. However, there were several minor alterations noted; an increase in the period of the oscillation and the variability of the growth rate and a diminished rhythm amplitude, which eventually damped out in 25% of the flight tubes. On day seven of the flight, the tubes were exposed to light while their growth fronts were marked. It appears that some aspects of this marking process reinstated a robust rhythm in all the tubes which continued throughout the remainder of the flight. It was hypothesized that the damping found prior to the marking procedure on STS-9 may have been a result of the hypergravity pulse of launch and not due to the microgravity of the orbital lab; furthermore, that the marking procedure, by exposing the samples to light, had reinstated rhythmicity. To test this, an investigation was conducted into the effects of acute and chronic exposure to hypergravity. Author

N87-28248* National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 301)
Sep. 1987 77 p
(NASA-SP-7011(301); NAS 1.21:7011(301)) Avail: NTIS HC A05 CSCL 06E

This bibliography lists 217 reports, articles, and other documents introduced into the NASA scientific and technical information system in August, 1987. Author

N87-28249# Naval Health Research Center, San Diego, Calif.
THE EFFECT OF SLEEP DEPRIVATION AND MODERATE INTERMITTENT EXERCISE ON MAXIMAL AEROBIC CAPACITY Interim Report
John E. Yeager, Ronald P. Crisman, and Anthony A. Sucec 15 Jan. 1987 16 p
(AD-A181934; NHRC-86-36) Avail: NTIS HC A02/MF A01 CSCL 06D

The purpose of this study was to determine the effects of moderate intermittent work (IW), partial sleep deprivation (PSD) and 8 hrs of recovery sleep (RS) on maximal oxygen uptake (VO2max). The IW consisted of two 20 hr periods separated by a 3 hr nap. Thirty male subjects with the following mean characteristics (age = 21.2 yrs, height = 176.6 cm, and weight = 74.9 kg) were randomly assigned to a non-exercising group (C), or an exercising group (E). Subjects were further randomly assigned to Noon (N) or Midnight (M) start times. Comparisons of low (L) and high (H) fitness levels based on baseline VO2max were also made. All groups underwent PSD with E walking on a treadmill at 30% of VO2max for 30 mins/hr VO2max, maximum heart rate (HRmax) and maximal treadmill walk times (WT) were measured three times; baseline (T1), after IW (T2) and after RS (T3). The L and H means for VO2max were 45.7 and 54.3 ml/kg/min, respectively, while all other group means were within 2 ml/kg/min of 50 ml/kg/min, STPD. Following PSD VO2max dropped 3.5% in C and increased 2.5% in E (P 0.05). The HRmax means were within 5 bts/min of 197/min for all groups, and the means WTs were between 12.0 and 12.8 mins with only the H and M groups demonstrating with means of 13.4 and 13.3 mins, respectively. The changes in C and E following PSD support the hypothesis that moderate IW counteracts PSD C and E following PSD induced decrements in VO2max. Neither fitness level nor start time altered the effect of PSD on VO2max. GRA

N87-28250# Naval Health Research Center, San Diego, Calif.
L-TRYPTOPHAN, SLEEP, AND PERFORMANCE Interim Report
Cheryl L. Spinweber 10 Mar. 1987 25 p
(AD-A181941; NHRC-87-4) Avail: NTIS HC A02/MF A01 CSCL 06O

Planning for adequate rest and predicting the consequences of inadequate sleep or cumulative sleep loss should be an important consideration in mission logistics. The use of a sleeping aid may be appropriate to permit personnel to maximize sleep effectiveness in operational environments. At NHRC, we have investigated the amino acid l-tryptophan as a non sedating sleeping aid for military use. Attention focused on l-tryptophan because of its role as the dietary precursor of serotonin. The neurotransmitter first identified by Jouvet as involved in the regulation of sleep. Recent reviews continue to debate the effectiveness of 1-tryptophan as a sleeping aid and the underlying mechanism for its effects. GRA

N87-28251# Naval Health Research Center, San Diego, Calif.
PERCEIVED EXERTION UNDER CONDITIONS OF SUSTAINED WORK AND SLEEP LOSS Interim Report
David H. Ryman, P. Naitoh, and C. E. Englund 25 Mar. 1987 22 p
(AD-A182148; AD-E900674; NHRC-87-9) Avail: NTIS HC A02/MF A01 CSCL 06J

The relationships of perceived exertion (RPE) to workload, heart rate, and psychological measures during repeated treadmill walking while carrying 22kg have been analyzed in 2 studies. Exercising subjects alternated 30 min walks with 30 min of tasks for 16 one hr sessions on each of 2 consecutive days. Study 1 used an initial treadmill grade and speed producing 40% maximum oxygen consumption (VO2 max). This level was maintained until a subject could no longer complete a 30 min exercise session. Subsequently treadmill grade and then speed were reduced to a maintainable rate. Subjects got a 4 hr nap (Group 1) or rest (Group 2) between days. Study 2 used 30% VO2 max throughout and a 3 hr nap between days. One group started at midnight, the other at noon. Both studies showed a linear increase in RPE during each day ($p < .05$) and a drop in RPE from the end of Day 1 to the start of Day 2 ($p < .001$). Napping rather than just resting or starting at midnight rather than at noon did not change RPE. RPE was higher Day 2 than Day 1 in Study 2 ($p < .05$). RPE increased through the stages of the maximal treadmill tests but did not vary among the 3 tests in Study 2. RPE was significantly correlated with heart rate, speed, and elevation gained (r and/or p) during most of Day 1 in Study 1 but not in Study 2. Psychological measures showed correlations with RPE only during the third 4 hr period of

Day 1 in Study 1 for fatigue, vigor and sleepiness while these relationships persisted through most of day 1 in study 2. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N87-28252# Air Force Human Resources Lab., Brooks AFB, Tex.
TIME-SHARING ABILITY AS A PREDICTOR OF FLIGHT TRAINING PERFORMANCE Interim Technical Paper Jan. 1983 - Sep. 1986
Thomas R. Carretta Jun. 1987 16 p
(AD-A181838; AFHRL-TP-86-69) Avail: NTIS HC A02/MF A01 CSCL 05I

Modern-day pilots must perform a variety of activities concurrently. In addition to flying the aircraft, they must monitor the communications channels and instrument panel and also navigate. As a result, the ability to allocate attention to different tasks effectively or time share is crucial for a safe, well-executed flight. A compensatory tracking and signal detection dual-task was administered to 1,130 United States Air Force pilot training candidates prior to entry into Undergraduate Pilot Training (UPT). Tracking performance was extremely reliable. Although performance on this task was not predictive of successful completion of UPT, it was related significantly to a post-UPT advanced training recommendation. This task may be useful when it is desirable to place candidates into specialized training tracks at an early point in training. GRA

N87-28253*# Texas Univ., Austin. Dept. of Psychology.
STUDYING FLIGHT CREW BEHAVIOR: A SOCIAL PSYCHOLOGIST ENCOUNTERS THE REAL WORLD
Robert L. Helmreich 1986 18 p Presented at the Annual Meeting of the American Psychological Association, Washington, D.C., Aug. 1986
(Grant NAG2-137)
(NASA-CR-180284; NAS 1.26:180284) Avail: NTIS HC A02/MF A01 CSCL 05I

Considerable social psychological research has been conducted on the relationship between personality and performance in various occupational settings. Of special interest are situations where the performer is under pressure or the consequences of poor performance can be serious, as in aircraft operation. Some significant findings are summarized, including those related to Type A personality factors, achievement motivation factors, and attitude factors. Future research should focus on group behavior. J.P.B.

N87-28254# European Space Agency, Paris (France).
REGULATION OF PERFORMANCE AND MONITORING OF ERRORS IN A TEST OF PERCEPTUAL SPEED
Klaus-Martin Goeters Jan. 1987 39 p Transl. into ENGLISH of "Leistungsregulation und Fehlerkontrolle in einen Aufmerksankeitstest mit Geschwindigkeitskomponente Original language document was announced as N87-12164
(ESA-TT-1010; DFVLR-FB-86-13; ETN-87-90010) Avail: NTIS HC A03/MF A01; original German version available from DFVLR, Cologne, West Germany DM 15

A test of perceptual speed (cancellation of figures) in which usually the number of rights and wrongs (omissions) are uncorrelated, was applied to three groups with different instructions. Group 1 was told to work quickly and accurately; group 2 to take care of the speed of work, and group 3 of accuracy. Subjects who were asked by a questionnaire about their attitudes during the work period and about their general style of work, emphasized the factors speed or accuracy while neglecting the other components. This procedure does not achieve the expected success. The result confirms the functional independence of speed of work and error rate in tests of mental concentration. ESA

N87-28255# European Space Agency, Paris (France).
THE VALUE OF GLOBAL SELF-RATINGS IN DIFFERENTIAL DIAGNOSTICS
Peter Maschke Mar. 1987 248 p Transl. into ENGLISH of "Zum Wert globaler Selbsteinschaetzungen in der Differentiellen Diagnostik,Hamburg, West Germany, Original language document was announced as N87-12165
(ESA-TT-1014; DFVLR-FB-86-20; ETN-87-90012) Avail: NTIS HC A11/MF A01; original German version available from DFVLR, Cologne, West Germany DM 66.50

Reliability validity and faking tendencies of a 10 dimensional personality inventory were compared with the corresponding global self ratings in a situation of job application. Global self ratings do not appear to be faked more than the personality test scales. Although there are distinct differences in reliability between self rating and personality scales, the latter attain only negligibly higher validities. Reasons for these results (unexpected from assumptions of classical testing theory) are discussed. In relation to self ratings in performance, there are indications of a capability of self assessment. ESA

N87-28256# Systems Control Technology, Inc., Arlington, Va.
AERONAUTICAL DECISION MAKING FOR STUDENT AND PRIVATE PILOTS Final Report
Alan E. Diehl, Peter V. Hwoschinsky, Russell S. Lawton, and Gary S. Livack May 1987 111 p Prepared in cooperation with AOPA Air Safety Foundation, Frederick, Md.
(Contract DTFA01-80-C-10080)
(AD-A182549; DOT/FAA/PM-86/41) Avail: NTIS HC A06/MF A01 CSCL 01B

Aviation accident data indicate that the majority of aircraft mishaps are due to judgment error. This manual is part of a project to develop materials and techniques to help improve pilot decision making. Training programs using prototype versions of these materials have demonstrated substantial reductions in pilot error rates. The results were statistically significant and ranged from approximately 10% to 50% fewer mistakes. This manual is designed to explain the risks associated with Student and Private pilot flying activities, the underlying behavioral causes of typical accidents, and the effects of stress on pilot decision making. It provides a means for the individual pilot to develop an attitude profile through a self-assessment inventory and provides detailed explanations of preflight and in-flight stress management techniques. The assumption is that pilots receiving this training will develop a positive attitude toward safety and the ability to manage stress effectively while recognizing and avoiding unnecessary risk. This manual is one of a series on Aeronautical Decision-Making prepared for the following pilot audiences: (1) student and private; (2) commercial; (3) instrument; (4) instructor; (5) helicopter, and (6) multicrew. GRA

N87-28257# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
GENERATION MODELS OF DECISION RULES: A CENTRAL APPROACH TO INDUCTIVE LEARNING M.S. Thesis [GERACAO DE MODELOS DE REGRAS DE DECISAP: UMA ABORDAGEM CENTRADA NA APRENDIZAGEM INDUTIVA]
Pedro Paulo BalbideOliveira Aug. 1987 167 p In PORTUGUESE; ENGLISH summary
(INPE-4299-TDL/276) Avail: NTIS HC A08/MF A01

Research for the creation of a mechanism to allow the generation of models (descriptions) of the rules which constitute a knowledge base is presented. The mechanism which was defined is based on an inductive learning process which is proposed, and works from rule classes defined in the base. Such classes are composed of rules which have some common conclusion clause and refer to a same set of objects. The learning approach allows the creation of disjuctive and conjunctive concepts. This process allows the generalization of disjunctive concepts for another that encompasses the former, which represents a simple way of knowledge-based learning. The learning mechanism was tested only for generation of characteristic descriptions, but, as it tried to show, it could also be used for the generation of discriminant

descriptions. The results obtained, as well as the acquired experience, allow the conclusion that, in order that the models may better specify the knowledge expressed in the base, more sophisticated ways of defining the rule classes are necessary.
Author

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

For related information see also *16 Space Transportation.*

N87-28258# Human Engineering Labs., Aberdeen Proving Ground, Md.
HUMAN FACTORS RESEARCH SIMULATOR Final Report
Gordon L. Herald Mar. 1987 34 p
(AD-A180816; HEL-TM-8-87) Avail: NTIS HC A03/MF A01 CSCL 05H

The development of a simulation capability to be used for a broad range of Army human factors research is described, including a low cost terrain imaging system that uses commercial off the shelf hardware. Design problems and consideration regarding aviation and air defense human factors simulators are discussed. An example of an aviation baseline system is included. GRA

N87-28259# Systems Control Technology, Inc., Dayton, Ohio.
A COCKPIT NATURAL LANGUAGE STUDY: DATA COLLECTION AND INITIAL DATA ANALYSIS Final Report, Oct. 1985 - Sep. 1986
Gretchen D. Lizza, Michael P. Munger, Ronald L. Small, Gregory L. Feitshans, and Stephen D. Detro Apr. 1987 377 p
(Contract F33615-85-C-3623; AF Proj. 2403)
(AD-A181306; SCT-5529-07; AFWAL-TR-87-3003) Avail: NTIS HC A17/MF A01 CSCL 05G

This report describes an initial attempt to study language used by fighter pilots. To this end, a methodology was adopted which entailed the use of a mission scenario, tape recording the experimental sessions, and analyzing the data according to various statistical and tabular methods. Fifty-four pilots from six organizations participated in the study and generated 656 unique words, abbreviations, and acronyms. The data base created in this study is meant to be a foundation for additional analyses. The statistical tables can provide researchers with sufficient descriptive material to define and conduct studies focusing on particular issues and hypotheses. Some of the major conclusions are: (1) the data gathering method and statistical/tabulation procedures are appropriate for this type of knowledge engineering; (2) as measured by vocabulary and rating scores, the sample was homogeneous with respect to differences among bases, aircraft, and pilots; (3) variations in vocabulary within situations are due to the pilots; and (4) variations in vocabulary across situations are due both to pilots and to differing task demands.
GRA

N87-28260# Sener, S.A., Madrid (Spain).
SERVICE MANIPULATOR ARM (SMA) FOR A ROBOTIC SERVICING EXPERIMENT (ROSE) Final Report
M. Fuentes, C. Compostizo, F. Doblas, A. Martinez, E. delaFuente, R. Gonzalo, J. L. Lacombe, G. Berger, and T. Blais Paris, France ESA Jun. 1986 106 p
(Contract ESTEC-6174/85-NL-AN(SC))
(ESA-CR(P)-2347; ETN-87-99994) Avail: NTIS HC A06/MF A01

The most important features of the Robotic Servicing Experiment (ROSE), where the servicing equipment such as the Service Manipulator System and the Orbit Replacement Units and the servicing operations are demonstrated in orbit within a representative scenario are identified. The shuttle was selected to carry all the necessary hardware and software into orbit and to provide resources required by the experiments. The in orbit operator will be located in the shuttle cabin or in a pressurized module close to the half pallet where the ROSE elements will be mounted inside the cargo bay. The ROSE and service manipulator arm development programs are outlined. ESA

N87-28261# Joint Publications Research Service, Arlington, Va.
USSR REPORT: ENGINEERING AND EQUIPMENT
23 Jun. 1987 76 p Transl. into ENGLISH from various Russian articles
(JPRS-UEQ-87-009) Copyright Avail: NTIS HC A05/MF A01

Topics addressed include: surface transportation, nuclear energy, industrial technology, turbine design, engine design, high-energy devices, optics, photography, and testing and materials. For individual titles, see N87-28262 through N87-28263.

N87-28262# Joint Publications Research Service, Arlington, Va.
DEVELOPMENT AND INVESTIGATION OF ACTIVE PNEUMATIC VIBRATION INSULATION SYSTEMS FOR HUMAN OPERATOR
A. V. Andreychikov *In its* USSR Report: Engineering and Equipment 23 Jun. 1987 p 22-30 Transl. into ENGLISH from Izvestiya Vysshikh Uchebnykh Zavedeniy: Mashinostroyeniye (Moscow, USSR), no. 2, Feb. 1987 p 94-98 (For primary document see N87-28261 22-54)
Copyright Avail: NTIS HC A05/MF A01

The results of full-scale investigations of the vibration-protection properties of three versions of pneumatic vibration-insulation systems for the seat of the human operator with pressure stabilizer are presented. The tests of the developed systems on modern high-speed 2TE116 and 2TE121 locomotives showed high effectiveness in the region of low and high vibration frequencies.
Author

N87-28263# Joint Publications Research Service, Arlington, Va.
APPLICATION OF AIR MICROEJECTOR IN VACUUM GRIPPING DEVICE OF INDUSTRIAL ROBOT
N. P. Zaporozhets *In its* USSR Report: Engineering and Equipment 23 Jun. 1987 p 28-30 Transl. into ENGLISH from Mekhanizatsiya i Avtomatizatsiya Proizvodstva (Moscow, USSR), no. 12, Dec. 1986 p 25 (For primary document see N87-28261 22-54)
Copyright Avail: NTIS HC A05/MF A01

Calculation (optimization) of the principal geometrical and dynamic parameters of an air microejector is a rather complicated process. Therefore, the organization of experiments with an air microejector for the purposes of accumulating data is justified. A line diagram of a vacuum gripping device based on an air microejector with the ejecting stream fed peripherally is presented. In association with the inevitability of leaks originating between the suction device and the surface of the part, it is suggested that atmospheric air be drawn in and ejected into the atmosphere again. The relationship between the degree of vacuum and the air microejector's parameters are represented. Experimental curves describing the relationship are presented. The results obtained make it possible to optimize the principal parameters of an air microejector with the ejecting stream fed peripherally. B.G.

N87-28264# Ohio State Univ., Columbus.
HUMAN JOINT ARTICULATION AND MOTION-RESISTIVE PROPERTIES Final Report, 13 Sep. 1983 - 13 Jul. 1986
Ali E. Engin and Shuenn-Muh Chen Apr. 1987 185 p
(Contract F33615-83-C-0510)
(AD-A182574; AAMRL-TR-87-011) Avail: NTIS HC A09/MF A01 CSCL 06D

Three-dimensional joint kinematics and motion resistive properties were measured for the shoulder, hip and elbow joints on ten male volunteers. A sonic three-dimensional spatial digitizing system was used to track multiple targets on adjacent body segments while each of the segments was moved through a maximum voluntary range of motion and also while it was subsequently forced to maximum voluntarily allowable ranges by an external force applicator. The data were used to reconstruct the segments kinematics, which were then related to the force required to attain given joint orientations. The final data are provided in a globographic presentation in which equal force values are

depicted as contours on a global surface. The resistive forces are expressed as functions of the orientation angles in spherical harmonic expansion form. Statistical analyses have been performed on these data to generate both means and variances for the kinematics and resistive force properties. The data have direct applicability to better understanding of the kinematics of human long bone joints; providing preliminary limits for safe joint ranges of motion and forces; and serving as a data base for analytical and mechanical models of the human body. GRA

55 SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N87-28265# Stanford Univ., Calif. Dept. of Statistics.
WORKSHOP ON ASSESSING UNCERTAINTY HELD IN MONTEREY, CALIFORNIA ON 13-14 NOVEMBER 1986
Herbert Solomon 16 Mar. 1987 289 p Workshop held in Monterey, Calif., 13-14 Nov. 1986
(Contract N00014-76-C-0475)
(AD-A180850) Avail: NTIS HC A13/MF A01 CSCL 12A

This document consists of a series of papers on various aspects of assessing uncertainty. Topics include fuzzy sets, belief functions, lower probability models, randomness, and Bayesian analysis. For individual titles, see N87-28266 through N87-28274.

N87-28266# Harvard Univ., Cambridge, Mass. Dept. of Statistics.
UNCERTAIN EVIDENCE AND ARTIFICIAL ANALYSIS c63
A. P. Dempster and Augustine Kong *In* Stanford Univ., Workshop on Assessing Uncertainty held in Monterey, California on 13-14 November 1986 16 Mar. 1987 17 p (For primary document see N87-28265 22-59)
(Contracts N00014-85-K-0496; DAAL03-86-K-0042)
(AD-P005292; RR-S-108) Avail: NTIS HC A13/MF A01 CSCL 09B

Belief function models form a natural basis for the construction of artificial analysts (e.g., expert systems) capable of uncertain judgments. Random samples of various types may be used as the uncertain evidence which defines the necessary probability structure for the model. The paper develops some simple examples to illustrate these ideas. Author (GRA)

N87-28267# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Statistics.
APPROXIMATING BELIEF FUNCTIONS IN A RULE-BASED SYSTEM c65
William F. Eddy *In* Stanford Univ., Workshop on Assessing Uncertainty held in Monterey, California on 13-14 November 1986 16 Mar. 1987 21 p (For primary document see N87-28265 22-59)
(Contract N00014-84-K-0588)
(AD-P005293) Avail: NTIS HC A13/MF A01 CSCL 12A

Rule-based expert systems have moved from a research activity in a small number of academic computer science departments to a growing commercial activity. This transition clearly indicates that the structure of a complex computer program enforced by a rule-based system (i.e., the clear separation of the decision-making process, the inference engine, from the data on which the decisions are based) is a useful step in the evolution of programming strategies. At the same time there has been a growing recognition that in most decision-making situations the data (i.e., the rule base and the initial evidence used to start the decision-making process) are not known with certainty and consequently the inference procedures used in traditional rule-based systems are inappropriate. Over the last decade a number of inference procedures which use various numerical representations of uncertainty have been developed for use in rule-based systems. However, for a variety of reasons (including the fact that there is little logical basis for the representations) none of them has been widely successful. Described is the status of an ongoing research project which attempts to use probability as the mechanism for representing uncertainty in a rule-based system. GRA

N87-28268# SRI International Corp., Menlo Park, Calif. Artificial Intelligence Center.
AUTOMATING ARGUMENT CONSTRUCTION c63
John D. Lowrance *In* Stanford Univ., Workshop on Assessing Uncertainty held in Monterey, California on 13-14 November 1986 16 Mar. 1987 20 p (For primary document see N87-28265 22-59)
(Contracts N00039-83-K-0656; DAAL02-85-C-0082)
(AD-P005294) Avail: NTIS HC A13/MF A01 CSCL 09B

Developed was a computer program (Gister) that supports the construction, modification, and analysis of evidential arguments. Gister supports an interactive, menu-drive, graphical interface that allows these structures to be easily understood and manipulated. The user simply selects from a menu to add an evidential operation to an analysis, to modify operation parameters, or to change any portion of a gallery. In response, Gister updates the analyses, allowing the user to explore quickly the space of alternative arguments. Unlike other expert systems, Gister is designed as a tool for the domain expert. With this tool, an expert can quickly and flexibly develop a line of reasoning specific to a given domain situation. At SRI, this approach has been applied to naval intelligence problems. New work is focusing on adapting this technology to multisource data fusion for the Army. GRA

N87-28269# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Statistics.
A BAYESIAN VIEW OF ASSESSING UNCERTAINTY AND COMPARING EXPERT OPINION c65
Morris H. DeGroot *In* Stanford Univ., Workshop on Assessing Uncertainty held in Monterey, California on 13-14 November 1986 16 Mar. 1987 24 p (For primary document see N87-28265 22-59)
(Grant NSF DMS-83-20618)
(AD-P005295; TR-387) Avail: NTIS HC A13/MF A01 CSCL 12A

A Bayesian approach to the problem of comparing experts or expert systems is presented. The question of who is an expert is considered and comparisons among well-calibrated experts are studied. The concept of refinement, in various equivalent forms, is used in this study. An informative example of the combination of the opinions of well-calibrated experts is described. Total orderings of the class of well-calibrated experts are derived from strictly proper scoring rules. Author (GRA)

N87-28270# British Columbia Univ., Vancouver.
GROUP DECISION ANALYSIS AND ITS APPLICATION TO COMBINING OPINIONS c65
James V. Zidek *In* Stanford Univ., Workshop on Assessing Uncertainty held in Monterey, California on 13-14 November 1986 16 Mar. 1987 31 p (For primary document see N87-28265 22-59)
(Grant NSF MCS-83-01808)
(AD-P005296) Avail: NTIS HC A13/MF A01 CSCL 12A

This paper is primarily about multi-Bayesian statistical decision theory. Thus the author is deliberately expanding this discussion beyond the realm of merely aggregating opinions. There are a number of reasons for doing so. There may well be situations involving groups of individuals wherein the real goal is merely that of combining degrees of belief concerning statements (hypotheses)

about the world. However, opinions in the usual sense of that word would generally incorporate preferences as well. There is even some reason to doubt that degrees of beliefs and preferences (utilities) can be separately elicited even in a normative setting. In short, there is some doubt as to whether the aggregation of degrees of belief is a meaningful undertaking. In any case, it would seem that in a significant number, if not the majority of situations involving groups of individuals, a joint decision is called for. This joint decision could itself be an aggregate of the individual expressions of degrees of belief. But this recasts the problem into the context of group decision making and redirects our interest towards this latter area. GRA

N87-28271# San Francisco State Univ., Calif. Dept. of Mathematics.
SURVEY OF RESEARCH ON FUZZY SETS IN THE SOVIET UNION **c67**
Sergei V. Ovchinnikov *In* Stanford Univ., Workshop on Assessing Uncertainty held in Monterey, California on 13-14 November 1986 16 Mar. 1987 31 p (For primary document see N87-28265 22-59)
(AD-P005297) Avail: NTIS HC A13/MF A01 CSCL 12A

The paper surveys Soviet literature on fuzzy set theory and applications. A bibliography containing about 250 titles is presented. GRA

N87-28272# Cornell Univ., Ithaca, N.Y. School of Electrical Engineering.
LOWER PROBABILITY MODELS FOR UNCERTAINTY AND NONDETERMINISTIC PROCESSES **c65**
Terrence L. Fine *In* Stanford Univ., Workshop on Assessing Uncertainty held in Monterey, California on 13-14 November 1986 16 Mar. 1987 36 p (For primary document see N87-28265 22-59)
(AD-P005299) Avail: NTIS HC A13/MF A01 CSCL 12A

This report on lower probability modeling contains the following: Introduction; Mathematical Background to Lower Probability; Representing Uncertainty; Representing Chance; Time Series Modelling; and References. GRA

N87-28273# George Mason Univ., Fairfax, Va.
ON RANDOMNESS, DETERMINISM AND COMPUTABILITY **c64**
Edward J. Wegman *In* Stanford Univ., Workshop on Assessing Uncertainty held in Monterey, California on 13-14 November 1986 16 Mar. 1987 21 p (For primary document see N87-28265 22-59)
(AD-P005300; TR-7) Avail: NTIS HC A13/MF A01 CSCL 12A

This paper discusses the meaning and relationship of randomness and determinism. A fundamental development of chaotic dynamical systems is given with examples. Such systems are seen to exhibit randomness in the usual sense of unpredictability. The formal definition of randomness in terms of algorithmic incompressibility is also discussed. The role of recursion in computability and randomness is also discussed.
Author (GRA)

N87-28274# Northwestern Univ., Evanston, Ill. Dept. of Statistics.
THE BAYESIAN ANALYSIS OF TESTIMONY **c65**
S. L. Zabell *In* Stanford Univ., Workshop on Assessing Uncertainty held in Monterey, California on 13-14 November 1986 16 Mar. 1987 44 p (For primary document see N87-28265 22-59)
(AD-P005301) Avail: NTIS HC A13/MF A01 CSCL 12A

The use of mathematical probability to analyze the probative force of testimony was among its earliest applications. For almost a century, the subject generated a substantial literature and was a common topic in the textbooks of the 19th century. From the very beginning, however, the theory suffered from a nearly universal failure to be grounded in empirical fact. In the end it became largely discredited, and today such attempts are often considered mere curiosities: naive, erroneous, or uninformative. Nevertheless, there are several reasons why there is value in reviewing the history of such attempts. First and foremost, the analysis of testimony -- how to combine several items of evidence, and how to combine the testimony of several witnesses -- stands as a genuine and important problem that any theory of uncertainty must grapple with. It is the thesis of this paper that the best such attempts provide useful insights, and that the admitted limitations in such analyses are largely inherent in the questions asked.
GRA

N87-28275*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TRADITIONAL VERSUS RULE-BASED PROGRAMMING TECHNIQUES: APPLICATION TO THE CONTROL OF OPTIONAL FLIGHT INFORMATION
Wendell R. Ricks and Kathy H. Abbott Jul. 1987 15 p
(NASA-TM-89161; NAS 1.15:89161) Avail: NTIS HC A02/MF A01 CSCL 12A

To the software design community, the concern over the costs associated with a program's execution time and implementation is great. It is always desirable, and sometimes imperative, that the proper programming technique is chosen which minimizes all costs for a given application or type of application. A study is described that compared cost-related factors associated with traditional programming techniques to rule-based programming techniques for a specific application. The results of this study favored the traditional approach regarding execution efficiency, but favored the rule-based approach regarding programmer productivity (implementation ease). Although this study examined a specific application, the results should be widely applicable. Author

N87-28276# Society for Industrial and Applied Mathematics, Philadelphia, Pa.
SIAM 1986 NATIONAL MEETING Final Technical Report
22 Sep. 1986 3 p Meeting held in Boston, Mass., 21-25 Jul. 1986
(Contract DE-FG02-86ER-25014)
(DE87-011015; DOE/ER-25014/1) Avail: NTIS HC A02/MF A01

A summary of the 1986 meeting of the Society for Industrial and Applied Mathematics (SIAM) is given. Included are lists of the invited speakers, special lectures, and the minisymposia.
DOE

60 COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware, and data processing.

For components see *33 Electronics and Electrical Engineering.*

N87-28277*# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
VALIDATION OF A FAULT-TOLERANT MULTIPROCESSOR: BASELINE EXPERIMENTS AND WORKLOAD IMPLEMENTATION
Frank Feather, Daniel Siewiorek, and Zary Segall 22 Jul. 1985 53 p
(Grant NAG1-190)
(NASA-CR-181238; NAS 1.26:181238; CMU-CS-85-145) Avail: NTIS HC A04/MF A01 CSCL 09B

In the future, aircraft must employ highly reliable multiprocessors in order to achieve flight safety. Such computers must be experimentally validated before they are deployed. This project outlines a methodology for validating reliable multiprocessors. The methodology begins with baseline experiments, which tests a single phenomenon. As experiments progress, tools for performance testing are developed. The methodology is used, in part, on the Fault Tolerant Multiprocessor (FTMP) at NASA-Langley's AIRLAB facility. Experiments are designed to evaluate the fault-free performance of the system. Presented are the results of interrupt

baseline experiments performed on FTMP. Interrupt causing exception conditions were tested, and several were found to have unimplemented interrupt handling software while one had an unimplemented interrupt vector. A synthetic workload model for realtime multiprocessors is then developed as an application level performance analysis tool. Details of the workload implementation and calibration are presented. Both the experimental methodology and the synthetic workload model are general enough to be applicable to reliable multiprocessors beside FTMP. Author

N87-28278# Naval Research Lab., Washington, D.C.
WORKSHOP ON RESEARCH AND DEVELOPMENT IN NAVAL HUMAN-COMPUTER INTERACTIVE SYSTEMS Memorandum Report, Oct. 1985 - Oct. 1986
Anthony F. Norcio and John J. OHare 24 Apr. 1987 224 p Workshop held in Washington, D.C., 21-22 Jul. 1986
(AD-A181915; NRL-MR-5971) Avail: NTIS HC A10/MF A01 CSCL 09B

An overview of these sessions indicated that: (1) there is an under-emphasis on science within the laboratories; in other words, the Navy is failing to provide a basis for developing HCI systems; (2) there is insufficient attention given to interactive aspects in HCI systems; that is, many Navy systems access, display, or store data rather than allow the user to manipulate, compute or analyze information; (3) there are too few opportunities for formal test and evaluation of component design alternatives during development; and (4) many Navy HCI groups are isolated; therefore, an annual workshop would be useful for sharing knowledge and fostering presentations on state-of-the-art research. GRA

N87-28279# California Univ., San Diego, La Jolla. Inst. for Cognitive Science.
METAPHORS FOR INTERFACE DESIGN
Edwin Hutchins Apr. 1987 33 p
(Contract N00014-85-C-0133; DA Proj. RR0-4206)
(AD-A182248; AD-E951026; ICS-8703) Avail: NTIS HC A03/MF A01 CSCL 09B

Computer system designers and computer users frequently utilize metaphors as organizing structures for dealing with the complexity of behavior of human/computer interfaces. This paper considers four metaphors concerning the mode of interaction between user and machine: the conversation metaphor, the declaration metaphor, the model world metaphor and the collaborative manipulation metaphor. It is argued that the key to the functional properties of an interface lie in the reference relations between the expressions in the interface language and the things to which the expressions refer. The ways in which such metaphors are suggested by advances in I/O technology and the ways they constrain the possibilities we see in technology are discussed. Each of the metaphors discussed promotes a particular type of reference relation. Furthermore, because the computer is a medium in which types of reference relations that are not possible in ordinary language can be realized, the space of interface metaphors is quite likely much larger than we presently imagine it to be. GRA

N87-28280# Westinghouse Research and Development Center, Pittsburgh, Pa.
OPTICAL ARCHITECTURES FOR MATRIX PROCESSING Final Report, 3 Sep. 1984 - 15 Apr. 1986
A. P. Goutzoulis and D. K. Davies Nov. 1986 190 p
(Contract F33615-84-C-1499)
(AD-A182874; AFWAL-TR-86-1117) Avail: NTIS HC A09/MF A01 CSCL 09B

A study to explore optical methods for performing eigen system calculation based on matrix vector or matrix multiplications has been completed. Several implementations of eigen system solution algorithms including digital multiplication by analog convolution and bit parallel multiplication were analyzed to determine performance/cost tradeoffs. All methods were determined to have unsatisfactory multiplication speed and efficiency. Two new approaches to the problem, optically interconnected electronic multipliers and position coded residue optoelectronic look-up table (LUT) processing, were proposed. After analysis and LUT implementation, both methods appear feasible and merit further investigation. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, alogorithms, and specific applications, e.g., CAD/CAM.

N87-28281*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE NATURE AND EVALUATION OF COMMERCIAL EXPERT SYSTEM BUILDING TOOLS, REVISION 1
William B. Gevarter Mar. 1987 30 p
(NASA-TM-88331-Rev-1; A-87076; NAS 1.15:88331-Rev-1)
Avail: NTIS HC A03/MF A01 CSCL 09B

This memorandum reviews the factors that constitute an Expert System Building Tool (ESBT) and evaluates current tools in terms of these factors. Evaluation of these tools is based on their structure and their alternative forms of knowledge representation, inference mechanisms and developer end-user interfaces. Next, functional capabilities, such as diagnosis and design, are related to alternative forms of mechanization. The characteristics and capabilities of existing commercial tools are then reviewed in terms of these criteria. Author

N87-28282# National Bureau of Standards, Gaithersburg, Md. Center for Programming Science and Technology.
REPORT ON THE NBS (NATIONAL BUREAU OF STANDARDS) SOFTWARE ACCEPTANCE TEST WORKSHOP, APRIL 1-2, 1986 Final Report
D. R. Wallace and J. C. Cherniavsky Mar. 1987 52 p Workshop held at Gaithersburg, Md., 1-2 Apr. 1986
(PB87-179891; NBS/SP-500/146; LC-87-619806) Avail: NTIS HC A04/MF A01 CSCL 09B

The Software Acceptance Test Workshop consisted of eight sessions divided over two days. The topics of the first day's sessions were acceptance testing of off-shelf software, test case selection techniques, automated support for software acceptance testing, and software acceptance criteria. The topics of the second day's sessions were the management of software acceptance testing, standardization issues in software acceptance testing research areas for software acceptance testing, and the state of practice in software acceptance testing. The charges given to all of the sessions, highlights of discussions from each of the sessions, and the conclusions of the workshop are described. GRA

N87-28283# Argonne National Lab., Ill. Mathematics and Computer Science Div.
PARALLEL COMPUTATION OF A DOMAIN DECOMPOSITION METHOD
R. C. Y. Chin, G. W. Hedstrom, J. S. Scroggs, and D. C. Sorensen Apr. 1987 17 p
(Contracts W-31-109-eng-38; W-7405-eng-48; DE-AC05-84OR21400; DE-FG02-85ER-25001)
(DE87-004344; ANL/MCS-TM-91) Avail: NTIS HC A02/MF A01

A parallel algorithm for the efficient solution of a singularly perturbed parabolic partial differential equation is presented. The method is based on domain decomposition dictated by singular perturbation analysis. A transformation is made to a coordinate system induced by the characteristics of the reduced hyperbolic equation. Asymptotic analysis is used to determine regions where certain reduced equations may be solved in place of the full equation. This reduces the number and size of the domains where the full equation must be solved. Parallelism is evident at two levels. Domain decomposition provides parallelism at the highest level, and within each domain there is ample opportunity to exploit additional parallelism. Important features of the method include independent solution of the characteristic curves at the lowest level and low communication requirements between processes

devoted to solving in the various domains. Tightly coupled processes are only required in domains where the full equation must be solved. The implementation and some aspects of the performance of this algorithm on existing parallel computers, and certain aspects of iterative solution of nonlinear probelms are also discussed. DOE

N87-28284# Illinois Univ., Urbana. Dept. of Computer Science.
IMPLEMENTATION OF S-STEP METHODS ON PARALLEL VECTOR ARCHITECTURES
A. T. Chronopoulos and C. W. Gear Jun. 1987 27 p
(Contract DE-FG02-87ER-25026)
(DE87-010820; DOE/ER-25026/7; UILU-ENG-87-1734; UIUCDCS-R-87-1346) Avail: NTIS HC A03/MF A01

Efficient implementation of the S-step Conjugate Gradient method on vector and parallel machines is discussed. The two different architecture models considered are the shared memory machines with memory hierarchy and the message passing private memory machines. For a parametrized vector architecture similar to CRAY-1 or CRAY-2 we show that S-CG used to solve an elliptic partial differential equation problem is twice as fast as CG. For the message passing parallel architectures (Hypercube) a speedup of 2s over CG can be achieved. DOE

N87-28285*# Ford Aerospace and Communications Corp., Houston, Tex. Space Information Systems Operation.
CALIBRATED ANCILLARY SYSTEM (CAS) USER'S GUIDE, VOLUME 1
31 May 1986 352 p
(Contract NAS9-15014)
(NASA-CR-171993; NAS 1.26:171993; SIS0-UG-001-Vol-1; DRL-LI81-Vol-1) Avail: NTIS HC A16/MF A01 CSCL 09B

The Calibrated Ancillary System (CAS) provides real-time calibrated parameters from the orbiter downlink (ancillary data) to the Goddard Space Flight Center (GSFC). This user's guide contains the introduction to the equipment, operation, general procedures, and specific procedures of the CAS. Volume 1 includes a general overview of the CAS relationships with other equipment, physical design, and hardware and software subsystems. In addition, a description of the user levels and tasks, an introduction to CAS operation, and an outline of general operating procedures are included. M.G.

N87-28286*# Ford Aerospace and Communications Corp., Houston, Tex. Space Information Systems Operation.
CALIBRATED ANCILLARY SYSTEM (CAS) USER'S GUIDE, VOLUME 2
31 May 1986 371 p
(Contract NAS9-15014)
(NASA-CR-171994; NAS 1.26:171994; SISO-UG-001-Vol-2; DRL-LI81-Vol-2) Avail: NTIS HC A16/MF A01 CSCL 09B

The Calibrated Ancillary System (CAS) provides real-time calibrated parameters from the orbiter downlink (ancillary data) to the Goddard Space Flight Center (GSFC). This user's guide contains the introduction to the equipment, operation, general procedures, and specific procedures of CAS. Volume 2 describes the central status and control (CSAC) procedures, supervisor procedures, and logging procedures. M.G.

N87-28287*# Ford Aerospace and Communications Corp., Houston, Tex. Space Information Systems Operation.
CALIBRATED ANCILLARY SYSTEM (CAS) USER'S GUIDE, VOLUME 3
31 May 1986 375 p
(Contract NAS9-15014)
(NASA-CR-171995; NAS 1.26:171995; SISO-UG-001-Vol-3; DRL-LI81-Vol-3) Avail: NTIS HC A16/MF A01 CSCL 09B

The Calibrated Ancillary System (CAS) provides real-time calibrated parameters from the orbiter downlink (ancillary data) to the Goddard Space Flight Center (GSFC). This user's guide contains the introduction to the equipment, operation, general procedures, and specific procedures of the CAS. Volume 3 describes logging and delogging procedures, real-time procedures, and error messages. M.G.

N87-28288*# Ford Aerospace and Communications Corp., Houston, Tex. Space Information Systems Operation.
CALIBRATED ANCILLARY SYSTEM (CAS) USER'S GUIDE, VOLUME 4
31 May 1986 492 p
(Contract NAS9-15014)
(NASA-CR-171996; NAS 1.26:171996; SISO-UG-001-Vol-4; DRL-LI81-Vol-4) Avail: NTIS HC A21/MF A01 CSCL 09B

The Calibrated Ancillary System (CAS) provides real-time calibrated parameters from the orbiter downlink (ancillary data) to the Goddard Space Flight Center (GSFC). This user's guide contains the introduction to the equipment, operation, general procedures, and specific procedures of the CAS. Volume 4 presents the GSFC user mission planning procedures covering the mission planning main menu, bulletin board system, ancillary products menu, utility menu procedures, and ancillary support files procedures. B.G.

N87-28289*# Ford Aerospace and Communications Corp., Houston, Tex. Space Information Systems Operation.
CALIBRATED ANCILLARY SYSTEM (CAS) USER'S GUIDE, VOLUME 5
31 May 1986 327 p
(Contract NAS9-15014)
(NASA-CR-171997; NAS 1.26:171997; SISO-UG-001-Vol-5; DRL-LI81-Vol-5) Avail: NTIS HC A15/MF A01 CSCL 09B

The Calibrated Ancillary System (CAS) provides real-time parameters from the orbiter downlink (ancillary data) to the Goddard Space Flight Center (GSFC). This user's guide contains the introduction to the equipment, operation, general procedures, and specific procedures of CAS. Volume 5 describes the testing user mission planning procedures including the bulletin board system and ancillary products procedures. Instructions for viewing the SDT/TDT (shuttle data tape/telemetry descriptor tape) data base and the file management menu are also given. M.G.

N87-28290*# Ford Aerospace and Communications Corp., Houston, Tex. Space Information Systems Operation.
CALIBRATED ANCILLARY SYSTEM (CAS) USER'S GUIDE, VOLUME 6
31 May 1986 285 p
(Contract NAS9-15014)
(NASA-CR-171998; NAS 1.26:171998; SISO-UG-001-Vol-6; DRL-LI81-Vol-6) Avail: NTIS HC A13/MF A01 CSCL 09B

The Calibrated Ancillary System (CAS) provides real-time calibrated parameters from the orbiter downlink (ancillary data) to the Goddard Space Flight Center (GSFC). This user's guide contains the introduction to the equipment, operation, general procedures, and specific procedures of CAS. Volume 6 describes ancillary products procedures, enhancement menu and processing task procedures for SDT/TDT (shuttle data tape/telemetry descriptor tape), database errors and network data driver (NDD) product menu procedures, and utility menu procedures. M.G.

N87-28291*# Ford Aerospace and Communications Corp., Houston, Tex. Space Information Systems Operation.
CALIBRATED ANCILLARY SYSTEM (CAS) USER'S GUIDE, VOLUME 7
31 May 1986 88 p
(Contract NAS9-15014)
(NASA-CR-171999; NAS 1.26:171999; SISO-UG-001-Vol-7; DRL-LI81-Vol-7) Avail: NTIS HC A05/MF A01 CSCL 09B

The Calibrated Ancillary System (CAS) provides real-time calibrated parameters from the orbiter downlink (ancillary data) to the Goddard Space Flight Center (GSFC). This user's guide contains the introduction to the equipment, operation, general procedures, and specific procedures of CAS. Volume 7 describes the data flow engineer (DFE) user mission planning procedures which include instructions for processing the SDT/TDT (shuttle data tape/telemetry descriptor tape). M.G.

N87-28292*# Ford Aerospace and Communications Corp., Houston, Tex. Space Information Systems Operation.
CALIBRATED ANCILLARY SYSTEM (CAS) USER'S GUIDE, VOLUME 8
31 May 1986 213 p
(Contract NAS9-15014)
(NASA-CR-172000; NAS 1.26:172000; SISO-UG-001-Vol-8; DRL-LI81-Vol-8) Avail: NTIS HC A10/MF A01 CSCL 09B

The Calibrated Ancillary System (CAS) provides real-time calibrated parameters from the orbiter downlink (ancillary data) to the Goddard Space Flight Center (GSFC). This user's guide contains the introduction to the equipment, operation, general procedures, and specific procedures of CAS. Volume 8 describes procedures for invoking checkout software, file maintenance procedures, system manager procedures. M.G.

N87-28293*# Ford Aerospace and Communications Corp., Houston, Tex. Space Information Systems Operation.
CALIBRATED ANCILLARY SYSTEM (CAS) USER'S GUIDE, VOLUME 9
31 May 1986 209 p
(Contract NAS9-15014)
(NASA-CR-172001; NAS 1.26:172001; SISO-UG-001-Vol-9; DRL-LI81-Vol-9) Avail: NTIS HC A10/MF A01 CSCL 09B

The Calibrated Ancillary System (CAS) provides real-time calibrated parameters from the orbiter downlink (ancillary data) to the Goddard Space Flight Center (GSFC). This user's guide contains the introduction to the equipment, operation, general procedures, and specific procedures of CAS. Volume 9 contains the menu-independent CAS commands. Examples of each command and command parameters are presented. A listing of acronyms and applicable documentation is also provided. M.G.

N87-28294# Computer Resources International A/S (Denmark).
Ada PILOT PROJECT Final Report
Henrik Berle, Carsten Bjernaa, Nicholas Mecredy, Anna Smart, and Soeren Soerensen Paris, France ESA 30 Sep. 1986 31 p
(Contract ESA-6473/85-NL-IW(SC))
(APP/CRI/DDC/3.0; ESA-CR(P)-2379; ETN-87-90164) Avail: NTIS HC A03/MF A01

Use of Ada in the ESA European Test Operation Language (ETOL) was studied. Results show that Ada is suitable for use in the ETOL environment. The stepwise implementation of ETOL to Ada should not proceed in the way defined for the project. Any conversion of the ETOL system (or a part of this system) to Ada should be implemented as a clean Ada version of the system and such a conversion should not include the Ada Gateway Interface. An example of a clean Ada version of ETOL is the ETOL SUBSET system. In the context of the changes to the architecture of the ETOL environment, the implementation of distributed stand-alone Ada processes interconnected via communication processors should be investigated. ESA

N87-28295*# Virginia Univ., Charlottesville. Dept. of Computer Science.
THE IMPLEMENTATION AND USE OF ADA ON DISTRIBUTED SYSTEMS WITH HIGH RELIABILITY REQUIREMENTS Annual Progress Report
J. C. Knight Jan. 1985 70 p
(Grant NAG1-260)
(NASA-CR-181244; NAS 1.26:181244; UVA/528213-CS85-106) Avail: NTIS HC A04/MF A01 CSCL 09B

The use and implementation of Ada in distributed environments in which reliability is the primary concern is investigated. Emphasis is placed on the possibility that a distributed system may be programmed entirely in Ada so that the individual tasks of the system are unconcerned with which processors they are executing on, and that failures may occur in the software or underlying hardware. A new linguistic construct, the colloquy, is introduced which solves the problems identified in an earlier proposal, the conversation. It was shown that the colloquy is at least as powerful as recovery blocks, but it is also as powerful as all the other language facilities proposed for other situations requiring backward error recovery: recovery blocks, deadlines, generalized exception handlers, traditional conversations, s-conversations, and exchanges. The major features that distinguish the colloquy are described. Sample programs that were written, but not executed, using the colloquy show that extensive backward error recovery can be included in these programs simply and elegantly. These ideas are being implemented in an experimental Ada test bed. Author

N87-28296*# Old Dominion Univ., Norfolk, Va. Dept. f Mechanical Engineering and Mechanics.
COMPUTERIZED DATA REDUCTION TECHNIQUES FOR NADIR VIEWING REMOTE SENSORS Final Report, 15 Feb. 1984 - 1 Apr. 1985
S. N. Tiwari and Barbara B. Gormsen Apr. 1985 13 p
(Grant NAG1-456)
(NASA-CR-181256; NAS 1.26:181256) Avail: NTIS HC A02/MF A01 CSCL 09B

Computer resources have been developed for the analysis and reduction of MAPS experimental data from the OSTA-1 payload. The MAPS Research Project is concerned with the measurement of the global distribution of mid-tropospheric carbon monoxide. The measurement technique for the MAPS instrument is based on non-dispersive gas filter radiometer operating in the nadir viewing mode. The MAPS experiment has two passive remote sensing instruments, the prototype instrument which is used to measure tropospheric air pollution from aircraft platforms and the third generation (OSTA) instrument which is used to measure carbon monoxide in the mid and upper troposphere from space platforms. Extensive effort was also expended in support of the MAPS/OSTA-3 shuttle flight. Specific capabilities and resources developed are discussed. Author

N87-28297*# Illinois Univ., Urbana-Champaign. Dept. of Computer Science.
PRELIMINARY DESIGN OF THE REDUNDANT SOFTWARE EXPERIMENT
Roy Campbell, Lionel Deimel, Dave Eckhardt, Jr., John Kelly, John Knight, Linda Lauterbach, Larry Lee, Dave McAllister, and John McHugh 23 Apr. 1985 29 p
(Grant NAG1-510)
(NASA-CR-181259; NAS 1.26:181259) Avail: NTIS HC A03/MF A01 CSCL 09B

The goal of the present experiment is to characterize the fault distributions of highly reliable software replicates, constructed using techniques and environments which are similar to those used in comtemporary industrial software facilities. The fault distributions and their effect on the reliability of fault tolerant configurations of the software will be determined through extensive life testing of the replicates against carefully constructed randomly generated test data. Each detected error will be carefully analyzed to provide insight in to their nature and cause. A direct objective is to develop techniques for reducing the intensity of coincident errors, thus increasing the reliability gain which can be achieved with fault tolerance. Data on the reliability gains realized, and the cost of the fault tolerant configurations can be used to design a companion experiment to determine the cost effectiveness of the fault tolerant strategy. Finally, the data and analysis produced by this experiment will be valuable to the software engineering community as a whole because it will provide a useful insight into the nature and cause of hard to find, subtle faults which escape standard software engineering validation techniques and thus persist far into the software life cycle. B.G.

N87-28298*# Illinois Univ., Urbana-Champaign. Dept. of Computer Science.
ANALYSIS OF ADAPTIVE ALGORITHMS FOR AN INTEGRATED COMMUNICATION NETWORK Semiannual Status Report, 1 Jun. - 30 Nov. 1985
Daniel A. Reed, Matthew Barr, and Kim Chong-kwon Nov. 1985 89 p
(Grant NAG1-595)

(NASA-CR-181263; NAS 1.26:181263; SASR-1) Avail: NTIS HC A05/MF A01 CSCL 09B

Techniques were examined that trade communication bandwidth for decreased transmission delays. When the network is lightly used, these schemes attempt to use additional network resources to decrease communication delays. As the network utilization rises, the schemes degrade gracefully, still providing service but with minimal use of the network. Because the schemes use a combination of circuit and packet switching, they should respond to variations in the types and amounts of network traffic. Also, a combination of circuit and packet switching to support the widely varying traffic demands imposed on an integrated network was investigated. The packet switched component is best suited to bursty traffic where some delays in delivery are acceptable. The circuit switched component is reserved for traffic that must meet real time constraints. Selected packet routing algorithms that might be used in an integrated network were simulated. An integrated traffic places widely varying workload demands on a network. Adaptive algorithms were identified, ones that respond to both the transient and evolutionary changes that arise in integrated networks. A new algorithm was developed, hybrid weighted routing, that adapts to workload changes. E.R.

N87-28299*# Boeing Commercial Airplane Co., Seattle, Wash.
DEVELOPMENT OF INTEGRATED PROGRAMS FOR AEROSPACE-VEHICLE DESIGN (IPAD)
O. L. Anderson, A. L. Calvery, D. A. Davis, L. Dickmann, D. H. Folger, E. N. Jochem, C. M. Kitto, and G. vonLimbach 19 Dec. 1977 316 p
(Contract NAS1-14700)
(NASA-CR-181274; NAS 1.26:181274; D6-IPAD-70040-D) Avail: NTIS HC A14/MF A01 CSCL 09B

Integrated Programs for Aerospace Vehicle Design (IPAD) system design requirements are given. The information is based on the IPAD User Requirements Document (D6-IPAD-70013-D) and the Integrated Information Processing Requirements Document (D6-IPAD-70012-D). General information about IPAD and a list of the system design requirements that are to be satisfied by the IPAD system are given. The system design requirements definition is to be considered as a baseline definition of the IPAD system design requirements. Author

N87-28300*# Illinois Univ., Urbana. Dept. of Computer Science.
SAGA: A PROJECT TO AUTOMATE THE MANAGEMENT OF SOFTWARE PRODUCTION SYSTEMS Midyear Report, 1985
Roy H. Campbell, Carol S. Beckman, Leonora Benzinger, George Beshers, David Hammerslag, John Kimball, Peter A. Kirslis, Hal Render, Paul Richards, and Robert Terwilliger 1985 176 p
(Grant NAG1-138)
(NASA-CR-181237; NAS 1.26:181237) Avail: NTIS HC A09/MF A01 CSCL 09B

The SAGA system is a software environment that is designed to support most of the software development activities that occur in a software lifecycle. The system can be configured to support specific software development applications using given programming languages, tools, and methodologies. Meta-tools are provided to ease configuration. The SAGA system consists of a small number of software components that are adapted by the meta-tools into specific tools for use in the software development application. The modules are design so that the meta-tools can construct an environment which is both integrated and flexible. The SAGA project is documented in several papers which are presented. For individual titles, see N87-28301 through N87-28306.

N87-28301*# Illinois Univ., Urbana. Dept. of Computer Science.
ENCOMPASS: A SAGA BASED ENVIRONMENT FOR THE COMPOSITON OF PROGRAMS AND SPECIFICATIONS, APPENDIX A
Robert B. Terwilliger and Roy H. Campbell *In its* SAGA: A Project to Automate the Management of Software Production Systems 1985 22 p Presented at the 19th Annual Hawaii Internation Conference on System Sciences, Jul. 1985 (For primary document see N87-28300 22-61)
Avail: NTIS HC A09/MF A01 CSCL 09B

ENCOMPASS is an example integrated software engineering environment being constructed by the SAGA project. ENCOMPASS supports the specification, design, construction and maintenance of efficient, validated, and verified programs in a modular programming language. The life cycle paradigm, schema of software configurations, and hierarchical library structure used by ENCOMPASS is presented. In ENCOMPASS, the software life cycle is viewed as a sequence of developments, each of which reuses components from the previous ones. Each development proceeds through the phases planning, requirements definition, validation, design, implementation, and system integration. The components in a software system are modeled as entities which have relationships between them. An entity may have different versions and different views of the same project are allowed. The simple entities supported by ENCOMPASS may be combined into modules which may be collected into projects. ENCOMPASS supports multiple programmers and projects using a hierarchical library system containing a workspace for each programmer; a project library for each project, and a global library common to all projects. Author

N87-28302*# Illinois Univ., Urbana. Dept. of Computer Science.
AN EXAMPLE OF A CONSTRUCTIVE SPECIFICATION OF A QUEUE, PRELIMINARY REPORT, APPENDIX B
Leonora Benzinger *In its* SAGA: A Project to Automate the Management of Software Production Systems 1985 10 p (For primary document see N87-28300 22-61)
Avail: NTIS HC A09/MF A01 CSCL 09B

An example is presented of the constructive specification of a queue which is done in the style of (Jones 80) using the Vienna Development Method. The basic approach is that of data type refinement. The techniques used are not restricted to those used by Jones, particularly with respect to the method for proving properties of the retrieve function for linked lists, however the notation is consistent with his. Author

N87-28303*# Illinois Univ., Urbana. Dept. of Computer Science.
TREE-ORIENTED INTERACTIVE PROCESSING WITH AN APPLICATION TO THEOREM-PROVING, APPENDIX E
David Hammerslag, Samuel N. Kamin, and Roy H. Campbell *In its* SAGA: A Project to Automate the Management of Software Production Systems 1985 15 p (For primary document see N87-28300 22-61)
Avail: NTIS HC A09/MF A01 CSCL 09B

The concept of unstructured structure editing and ted, an editor for unstructured trees, is described. Ted is used to manipulate hierarchies of information in an unrestricted manner. The tool was implemented and applied to the problem of organizing formal proofs. As a proof management tool, it maintains the validity of a proof and its constituent lemmas independently from the methods used to validate the proof. It includes an adaptable interface which may be used to invoke theorem provers and other aids to proof construction. Using ted, a user may construct, maintain, and verify formal proofs using a variety of theorem provers, proof checkers, and formatters. Author

N87-28304*# Illinois Univ., Urbana. Dept. of Computer Science.
PCG: A PROTOTYPE INCREMENTAL COMPILATION FACILITY FOR THE SAGA ENVIRONMENT, APPENDIX F
Joseph John Kimball *In its* SAGA: A Project to Automate the Management of Software Production Systems 1985 58 p (For primary document see N87-28300 22-61)
Avail: NTIS HC A09/MF A01 CSCL 09B

A programming environment supports the activity of developing and maintaining software. New environments provide language-oriented tools such as syntax-directed editors, whose

usefulness is enhanced because they embody language-specific knowledge. When syntactic and semantic analysis occur early in the cycle of program production, that is, during editing, the use of a standard compiler is inefficient, for it must re-analyze the program before generating code. Likewise, it is inefficient to recompile an entire file, when the editor can determine that only portions of it need updating. The pcg, or Pascal code generation, facility described here generates code directly from the syntax trees produced by the SAGA syntax directed Pascal editor. By preserving the intermediate code used in the previous compilation, it can limit recompilation to the routines actually modified by editing.
Author

N87-28305*# Illinois Univ., Urbana. Dept. of Computer Science.
WRITING FILTER PROCESSES FOR THE SAGA EDITOR, APPENDIX G
Peter A. Kirslis *In its* SAGA: A Project to Automate the Management of Software Production Systems 1985 15 p (For primary document see N87-28300 22-61)
Avail: NTIS HC A09/MF A01 CSCL 09B

The SAGA editor provides a mechanism by which separate processes can be invoked during an editing session to traverse portions of the parse tree being edited. These processes, termed filter processes, read, analyze, and possibly transform the parse tree, returning the result to the editor. By defining new commands with the editor's user defined command facility, which invoke filter processes, authors of filter can provide complex operations as simple commands. A tree plotter, pretty printer, and Pascal tree transformation program were already written using this facility. The filter processes are introduced, parse tree structure is described and the library interface made available to the programmer. Also discussed is how to compile and run filter processes. Examples are presented to illustrate aspect of each of these areas. Author

N87-28306*# Illinois Univ., Urbana. Dept. of Computer Science.
MANUAL PAGES FOR SAGA SOFTWARE TOOLS, APPENDIX H
Carol S. Beckman, George Beshers, David Hammerslag, Peter A. Kirslis, Hal Render, and Robert Terwilliger *In its* SAGA: A Project to Automate the Management of Software Production Systems 1985 29 p (For primary document see N87-28300 22-61)
Avail: NTIS HC A09/MF A01 CSCL 09B

Several pages from the SAGA UNIX programmer's manual are presented. These pages are for SAGA software tools. E.R.

N87-28307*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PERFORMANCE ISSUES FOR DOMAIN-ORIENTED TIME-DRIVEN DISTRIBUTED SIMULATIONS
David M. Nicol (College of William and Mary, Williamsburg, Va.) Jul. 1987 12 p Submitted for publication
(Contract NAS1-18107)
(NASA-CR-178351; ICASE-87-50; NAS 1.26:178351) Avail: NTIS HC A02/MF A01 CSCL 09B

It has long been recognized that simulations form an interesting and important class of computations that may benefit from distributed or parallel processing. Since the point of parallel processing is improved performance, the recent proliferation of multiprocessors requires that we consider the performance issues that naturally arise when attempting to implement a distributed simulation. Three such issues are: (1) the problem of mapping the simulation onto the architecture, (2) the possibilities for performing redundant computation in order to reduce communication, and (3) the avoidance of deadlock due to distributed contention for message-buffer space. These issues are discussed in the context of a battlefield simulation implemented on a medium-scale multiprocessor message-passing architecture.
Author

N87-28308# Los Alamos National Lab., N. Mex.
SABRINA: AN INTERACTIVE 3-DIMENSIONAL GEOMETRY-MODELING PROGRAM FOR MCNP
James T. West, III, R. Lynn Byers, ed., and Helen M. Byers Oct. 1986 103 p Original document contains color illustrations
(LA-10688-M) Avail: NTIS HC A06/MF A01

SABRINA is a fully interactive three-dimensional geometry-modeling program for MCNP, a Los Alamos Monte Carlo code for neutron and photon transport. In SABRINA, a user constructs either body geometry or surface geometry models and debugs spatial descriptions for the resulting objects. This enhanced capability significantly reduces effort in constructing and debugging complicated three-dimensional geometry models for Monte Carlo analysis.
Author

N87-28309# Maryland Univ., College Park. Dept. of Computer Science.
REAL TIME PROGRAMS. DESIGN IMPLEMENTATION OF VALIDATION: A SURVEY
Shem-Tov Levi and Ashok K. Agrawala Apr. 1987 88 p
(Contract N00014-87-K-0124)
(AD-A182144; AD-E900674; CS-TR-1837) Avail: NTIS HC A05/MF A01 CSCL 09B

The use of real-time systems is wide spread today, and involves very large and sophisticated programs. In addition to the constraints imposed on regular very large programs, real-time very large programs are subjected to stringent real-time constraints that the designer tries to meet, to satisfy, and to validate. Those very large programs (systems) are of a very complicated nature, and need special methodologies. This review tries to summarize the methods, approaches, techniques and tools which are used today during a real time system's life cycle. The review deals with three important phases of a real-time system: the design phase, the implementation phase, and the validation phase. GRA

N87-28310# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
A SPACE-EFFICIENT ALGORITHM FOR FINDING THE CONNECTED COMPONENTS OF RECTANGLES IN THE PLANE
Charles E. Leiserson and Cynthia A. Phillips Feb. 1987 22 p
(Contract N00014-80-C-0622)
(AD-A182201; MIT/LCS/TM-323) Avail: NTIS HC A02/MF A01 CSCL 09B

An algorithm is presented for determining the connectivity of a set of N rectangles in the plane, a problem central to avoiding aliasing in VLSI design rule checkers. Previous algorithms for this problem either worked slowly with a small amount of primary memory space, or worked quickly but used more space. Our algorithm uses O(W) primary memory space, where W, the scan width, is the maximum number of rectangles to cross any vertical cut. The algorithm runs in O(N 1g N) time and requires no more than O(N) transfers between primary and secondary memory.
GRA

N87-28311# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
A COMPARISON OF HAMMING AND HOPFIELD NEURAL NETS FOR PATTERN CLASSIFICATION
R. P. Lippmann, B. Gold, and M. L. Malpass 21 May 1987 41 p
(Contract F19628-85-C-0002)
(AD-A182255; TR-769; ESD-TR-86-131) Avail: NTIS HC A03/MF A01 CSCL 09B

The Hopfield model neural net has attracted much recent attention. One use of the Hopfield net is as a highly parallel content addressable memory, where retrieval is possible although the input is corrupted by noise. For binary input patterns, an alternate approach is to compute Hamming distances between the input pattern and each of the stored patterns and retrieve that stored pattern with minimum Hamming distance. It is first shown that this is an optimum processor when the noise is statistically independent from bit to bit. Then a Hamming Neural Net is presented which is

a highly parallel implementation of this algorithm that uses computational elements similar to those used in a Hopfield net. The Hopfield and Hamming nets are compared for several applications. For the cases considered, the Hamming net generally outperforms the Hopfield net. Also, the Hamming net requires fewer interconnects than the fully connected Hopfield net. GRA

N87-28312# Colorado Univ., Boulder. Dept. of Electrical and Computer Engineering.
OPTICAL SYMBOLIC COMPUTING Final Report, 1 May 1986 - 30 Apr. 1987
Wade T. Cathey, Rodney A. Schmidt, and Garret Moddel 30 Apr. 1987 94 p
(Grant AF-AFOSR-0189-86)
(AD-A182511; Rept-153-6920; AFOSR-87-0751TR) Avail: NTIS HC A05/MF A01 CSCL 09B

Computer simulation programs have been written to simulate optical symbolic systems. The simulation includes ferroelectric liquid crystals, detectors, and conventional optical components. Individual components have been assembled and tested. The next phase of the work is to assemble a simple, but complete, demonstration system, compare the results with the simulations, and to correct the simulations. The design and simulation of more complex systems will be performed. GRA

N87-28313# Washington State Univ., Pullman.
RAPIDLY CONVERGENT ALGORITHMS FOR NONSMOOTH OPTIMIZATION Annual Scientific Report, 15 Jul. 1985 - 14 Jul. 1986
Robert Mifflin 14 Jul. 1986 5 p
(Grant AF-AFOSR-0210-83)
(AD-A182531; AFOSR-87-0801TR) Avail: NTIS HC A02/MF A01 CSCL 09B

The research supported under this grant has led to new developments for solving nonlinear optimization problems involving functions that are not everywhere differentiable and/or are implicitly defined, such as those that arise from dual formulations of optimization models. A new result has been proved showing rapid convergence of an algorithm for the single variable case where generalized derivations are available. For the single variable case where only function values are used a safeguarded bracketing technique has been introduced which guarantees convergence for lower semicontinuous functions and preserves rapid convergence of polyhedral and/or polynomial fitting algorithms. A safeguarded polyhedral/quadratic fitting algorithm has been developed which has better than linear convergence for certain piecewise twice continously differentiable functions. Ideas from the single variable case are being extended to the multi-variable case.
Author (GRA)

N87-28314# Naval Academy, Annapolis, Md.
A KNOWLEDGE BASED SYSTEM FOR PILOTING AN AUTONOMOUS LAND VEHICLE Final Report, 1986 - 1987
John P. Mellor 19 May 1987 131 p
(AD-A182569; USNA-TSPR-147) Avail: NTIS HC A07/MF A01 CSCL 09B

The objective was to construct a simulation consisting of models of the world and of a vehicle. The simulation was constructed using object oriented programming, and because of its structure facilitates a dynamic world, multiple vehicles, learning, reasoning about time, and incremental development of the vehicle and world. In addition, the pilot uses three dimensional information for path planning. With the exception of this project, there are no actual vehicles which use three dimensional path planning. The simulation is implemented on a Lisp machine using an object oriented programming package called Knowledge Engineering Environment (KEE), produced by Intellicorp. The simulation provides the vehicle with realistic sensor information and is capable of simulating a dynamic world. The sensor information provided to the vehicle was used by a piloting routine to pilot the vehicle to a goal while avoiding obstacles. Its performance decreased as clutter increased. In all cases the pilot was able to avoid collisions, but in some cases was unable to reach the goal. GRA

N87-28315# Texas Univ., Austin. Computer and Vision Research Center.
AUTOMATION RECOGNITION OF TRACKING OF OBJECTS Final Report, 1 Jan. 1985 - 31 Dec. 1986
J. K. Aggarwal 31 Dec. 1986 24 p
(Contract F49620-85-K-0007)
(AD-A182736; AFOSR-87-0893TR) Avail: NTIS HC A02/MF A01 CSCL 17E

The Computer and Vision Research Center conducts a broad program of research in computer vision, image processing, and architectures for image processing. During the period of this report, several projects were pursued including those on positioning and tracking of objects moving in space, parallel image processing, and 3-D representation and recognition. The results on these six completed projects are briefly presented in this report: representation of objects from range maps; hierarchical data structures for the computation of 3-D information from multiple views; structure and motion computation from point or line correspondences in images; surface reconstruction and representation of 3-D scenes; parallel 2-D convolution on a mesh connected array processor; and a parallel processing technique exploiting image parallelism via the hypercube. GRA

N87-28316# Illinois Univ., Urbana. Coordinated Science Lab.
REPRESENTATION AND THREE-DIMENSIONAL INTERPRETATION OF IMAGE TEXTURE: AN INTEGRATED APPROACH
Dorothea Blostein and Narendra Ahuja Apr. 1987 132 p
(Grant AF-AFOSR-0100-87)
(AD-A182866; UILU-ENG-87-2226) Avail: NTIS HC A07/MF A01 CSCL 09B

A perspective view of a slanted textured surface shows systematic changes in density, area and aspect-ratio of texture elements. The apparent changes in texture element properties can be analyzed to recover information about the physical layout of the scene. In practice it is difficult to identify texture elements, especially in images where the texture elements are partially occluded or are themselves textured at a finer scale. To solve this problem, it is necessary to integrate the extraction of texture elements with the recognition of scene layout. This paper presents a method for recovering the orientation of textured surfaces while simultaneously identifying texture elements. Candidate texture elements are constructed from overlapping circular regions of relatively uniform gray level. The uniform circular regions are found by convolving the image with Del sq G (Laplacian-of-Gaussian) masks over a range of scales, and comparing the convolution output to that expected for a circular disk of constant gray level. True texture elements are selected from the set of candidate texture elements by finding the planar surface that best predicts the properties of the candidate texture elements. A planar fit is evaluated by comparing the predicted texture-element areas to the actual areas of the candidate texture elements. The planar fit receiving support from the most regions is chosen as the correct interpretation. GRA

N87-28317*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
THE pEst VERSION 2.1 USER'S MANUAL
James E. Murray and Richard E. Maine Sep. 1987 75 p
(NASA-TM-88280; H-1390; NAS 1.15:88280) Avail: NTIS HC A04/MF A01 CSCL 09B

This report is a user's manual for version 2.1 of pEst, a FORTRAN 77 computer program for interactive parameter estimation in nonlinear dynamic systems. The pEst program allows the user complete generality in definig the nonlinear equations of motion used in the analysis. The equations of motion are specified by a set of FORTRAN subroutines; a set of routines for a general aircraft model is supplied with the program and is described in the report. The report also briefly discusses the scope of the parameter estimation problem the program addresses. The report gives detailed explanations of the purpose and usage of all available program commands and a description of the computational algorithms used in the program. Author

N87-28318# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Ministerio da Ciencia e Tecnologia.
IMAGE REGISTRATION BY SEQUENTIAL TESTS OF HYPOTHESES: THE RELATIONSHIP BETWEEN GAUSSIAN AND BINOMIAL MODELS
Nelson D. A. Mascarenhas and Guaraci Jose Erthal Jul. 1987 20 p Submitted for publication
(INPE-4209-PRE/1090) Avail: NTIS HC A02/MF A01

Relationships between gaussian and binomial models for digital image registration are established. First, a derivation is made of the probability curve of the binary error being equal to one, at the registration point, versus the signal-to-noise ratio. Second, the set of probability curves of the binary error being equal to one versus the distance from registration point is derived. Third, the set of curves relating the error variance versus the displacement is also obtained. Finally, a comparison between the theoretical curves and the experimental results is performed. Author

N87-28319# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A SUBGRADIENT ALGORITHM FOR THE MULTIDIMENSIONAL 0-1 KNAPSACK PROBLEM
Luiz Antonio NogueiraLorena, Acioli AntoniodeOlivo, and Paulo RobertodeOliveira Jun. 1987 15 p Presented at the 11th Triennial Conference on Operations Research, Buenos Aires, Argentina, 10-14 Aug. 1987
(INPE-4203-PRE/1084) Avail: NTIS HC A02/MF A01

A subgradient method is applied to approximate a solution for the multidimensional 0-1 knapsack problem (MKP). At each iteration a Lagrangian problem with a cut constraint for the objective function of MKP is solved. In computational tests with problems taken from the literature, this algorithm provided bounds that were very close to the optimal solution (less than 1 percent error), a performance that is comparable with the best known algorithms. Tests made with random generated problems also presented excellent results. Author

N87-28320# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE MANAGEMENT OF INEXACT DATA IN THE MOTIN SYSTEM: INFERENCE MACHINE FOR EXPERT SYSTEMS [O TRATAMENTO DE INCERTEZA NO SISTEMA MOTIN: MOTOR DE INFERENCIA PARA SISTEMAS ESPECIALISTAS]
Edson Luiz FrancaSenne Jul. 1987 23 p In PORTUGUESE; ENGLISH summary Presented at the 3rd Regional Meeting of Applied Mathematics and Computations, Sao Jose dos Campos, Brazil, 18-20 May 1987
(INPE-4261-PRE/1134) Avail: NTIS HC A02/MF A01

The MOTIN system, a kernel of a tool for building expert systems, is being developed by the Artificial Intelligence Group at INPE. This system uses a semantic network of stored structured and well-established knowledge of a domain, and decision rules to deal with empirical and inexact knowledge. This work shows the approach used by MOTIN for managing inexact data for decision rules application, approach allows MOTIN to use the structure of domain values for reasoning at varying levels of abstraction. Author

N87-28321# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Ministerio da Ciencia e Tecnologia.
A PSEUDO-POLYNOMIAL ALGORITHM FOR THE VALUE INDEPENDENT O-1 KNAPSACK PROBLEM [UM ALGORITMO PSEUDOPOLINOMIAL PARA O PROBLEMA DA MOCHILA O-1 DE VALOR INDEPENDENTE]
Horacio Hideki Yanasse and Nei Yoshihiro Soma Jun. 1987 12 p In PORTUGUESE; ENGLISH summary Prepared for presentation at the 15th Brazilian Symposium of Operational Research, Salvador, Bahia, 4-6 Nov. 1987
(INPE-4186-PRE/1075) Avail: NTIS HC A02/MF A01

Enumerative pseudopolynomial algorithm for solving the value independent O-1 knapsack problem is presented. This algorithm is an adaptation of Yanasse and Soma's algorithm for solving the O-1 linear diophantine equation. This adaptation maintains the same computational complexity of the original algorithm but has a slight increase in memory requirements. Author

N87-28322# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PROPOSAL OF A SOFTWARE SYSTEM FOR SATELLITE TESTING M.S. Thesis— 24 Jun. 1986 [PROPOSTA DE UM SISTEMA DE SOFTWARE PARA TESTE DE SATELITES]
Guido Milan Ambroz Aug. 1987 133 p In PORTUGUESE; ENGLISH summary
(INPE-4316-TDL/283) Avail: NTIS HC A07/MF A01

In contribution to the development of the Banco de Teste (BT), which is a satellite test system, this work aims to present the survey of the functional requirements for the satellite testing specific software of the BT and to propose a method to be followed by the above development, with software engineering tools and techniques for real-time systems. Author

N87-28323*# Computer Sciences Corp., Hampton, Va.
TRANSFERABLE OUTPUT ASCII DATA (TOAD) FILE FORMAT DESCRIPTION
Bradford Bingel and Dana Hammond Sep. 1987 35 p
(Contract NAS1-17999)
(NASA-CR-178361; NAS 1.26:178361) Avail: NTIS HC A03/MF A01 CSCL 09B

Described is a format for writing ASCII data on a file to facilitate its transfer from one computer system to another. The TOAD format conforms to all ANSI FORTRAN 77 standards. There are two advantages in using the TOAD format. First, TOAD files are of the preferred type and record length to make them easy to edit, read from and write on magnetic tape, or transfer across communications networks. Secondly, application programs, using the TOAD format to write computational results, are more portable and the answer files easier to postprocess. TOAD utility software is listed in an appendix. Author

62 COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

N87-28324# Saab-Scania, Goteberg (Sweden).
FAULT TOLERANCE DATA SYSTEMS Final Report
J. Hanje, J. Torin, M. Svenningsson, B. Andersson, A. Carlsson, H. Guilhem, N. Dujardin, C. Choret, and K. A. McRae (Marconi Space and Defence Systems Ltd., Portsmouth, England) Paris, France ESA Sep. 1986 89 p
(Contract ESTEC-6074/84-NL-PB)
(FTDS/REP/0001/SAAB; ESA-CR(P)-2377; ETN-87-90161)
Avail: NTIS HC A05/MF A01

The technical requirements on a fault tolerant spaceborne computer were established, and a modular architecture was designed. Semiconductor technology, packaging technology, hardware, software, hardware/software integration, and test equipment needs were analyzed. A development plan and organizational structure are proposed. ESA

N87-28325*# Georgia Inst. of Tech., Atlanta. School of Information and Computer Science.
A SUPPORT ARCHITECTURE FOR RELIABLE DISTRIBUTED COMPUTING SYSTEMS Interim Technical Report, 9 Nov. 1983 - 3 Dec. 1985
Martin S. McKendry 12 Feb. 1986 70 p
(Grant NAG1-430)
(NASA-CR-181272; NAS 1.26:181272) Avail: NTIS HC A04/MF A01 CSCL 09B

The Clouds kernel design was through several design phases and is nearly complete. The object manager, the process manager, the storage manager, the communications manager, and the actions manager are examined. For individual titles, see N87-28326 through N87-28327.

N87-28326*# Georgia Inst. of Tech., Atlanta. The Clouds Project.
NOTES ON A STORAGE MANAGER FOR THE CLOUDS KERNEL
David V. Pitts and Eugene H. Spafford *In its* A Support Architecture for Reliable Distributed Computing Systems 12 Feb. 1986 34 p (For primary document see N87-28325 22-62)
(Grant NSF DCR-83-16590)
(GIT-ICS-85/02) Avail: NTIS HC A04/MF A01 CSCL 09B

The Clouds project is research directed towards producing a reliable distributed computing system. The initial goal is to produce a kernel which provides a reliable environment with which a distributed operating system can be built. The Clouds kernal consists of a set of replicated subkernels, each of which runs on a machine in the Clouds system. Each subkernel is responsible for the management of resources on its machine; the subkernal components communicate to provide the cooperation necessary to meld the various machines into one kernel. The implementation of a kernel-level storage manager that supports reliability is documented. The storage manager is a part of each subkernel and maintains the secondary storage residing at each machine in the distributed system. In addition to providing the usual data transfer services, the storage manager ensures that data being stored survives machine and system crashes, and that the secondary storage of a failed machine is recovered (made consistent) automatically when the machine is restarted. Since the storage manager is part of the Clouds kernel, efficiency of operation is also a concern. Author

N87-28327*# Georgia Inst. of Tech., Atlanta. School of Information and Computer Science.
KERNEL STRUCTURES FOR CLOUDS
Eugene H. Spafford and Martin S. McKendry *In its* A Support Architecture for Reliable Distributed Computing Systems 12 Feb. 1986 24 p (For primary document see N87-28325 22-62)
(Grant NSF DCR-83-16590)
(GIT-ICS-84/09) Avail: NTIS HC A04/MF A01 CSCL 09B

An overview of the internal structure of the Clouds kernel was presented. An indication of how these structures will interact in the prototype Clouds implementation is given. Many specific details have yet to be determined and await experimentation with an actual working system. B.G.

N87-28328# Oak Ridge National Lab., Tenn.
PARALLEL COMPUTING ON A HYPERCUBE: AN OVERVIEW OF THE ARCHITECTURE AND SOME APPLICATIONS
G. Ostrouchov 1987 7 p Presented at the 19th Symposium on the Interface of Computer Science and Statistics, Philadelphia, Pa., 8 Mar. 1987
(Contract DE-AC05-84OR-21400)
(DE87-010020; CONF-8703131-1) Avail: NTIS HC A02

A hypercube parallel computer is a network of processors, each with only local memory, whose activities are coordinated by messages the processors send between themselves. The interconnection network corresponds to the edges of an n-dimensional cube with a processor at each vertex. This paper gives an overview of the hypercube architecture and its relation to other distributed-memory message-passing multiprocessors. The computation of a crossproducts matrix is an important part of many applications in statistics and provides a simple yet interesting example of a hypercube algorithm. This example is presented to illustrate the concepts in programming of a hypercube. DOE

N87-28329# Carnegie-Mellon Univ., Pittsburgh, Pa. Software Engineering Inst.
RELATIONSHIP BETWEEN IDL (INTERFACE DESCRIPTION LANGUAGE) AND STRUCTURE EDITOR GENERATION TECHNOLOGY Final Report
Peter H. Feiler Sep. 1986 14 p
(Contract F19628-85-C-0003)
(AD-A181937; CMU/SEI-86-TM-13; ESD-TR-86-220) Avail: NTIS HC A02/MF A01 CSCL 09B

This paper discusses observed commonalities and differences between IDL and structure editor generation technologies. IDL (interface description language) is technology for generation of tool intercommunication support with roots in compiler generation. Structure editor generation technology has its roots in syntax-directed editors. It produces environments for interactive viewing and manipulation of formally specified structures. Both technologies use a formal notation for structural and constraint descriptions. From these descriptions both generation tools automatically produce software for reading, writing, and manipulating instances of the described structures, as well as for checking specified constraints on information contained in the structures. The IDL technology emphasizes generation of batch-oriented applications while the structure editor generation technology is tailored to supporting interactive applications. Structure editor generation technology has been applied to itself, i.e., to building an interactive structure editor generation environment. Author (GRA)

N87-28330# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PROPOSED LOCAL AREA NETWORKS (LAN) M.S. Thesis - Jul. 1986 [PROPOSTA DE UMA REDE LOCAL DE COMUNICACAO DE DADOS]
Francisco deAssis FerreiraGomesFilho May 1987 194 p In PORTUGUESE; ENGLISH summary
(INPE-4173-TDL/273) Avail: NTIS HC A09/MF A01

Local Area Networks (LAN) were used to provide a rapid and reliable communication channel at low cost between computers and/or intelligent devices. A collection of the most relevant topics to carry out the LAN selection and design are presented. Diverse topologies, transmission media, coding techniques, and mainly transmission access modes most used in LANs are analyzed. A performance comparison is made between these access modes in terms of delay versus requirements developed. A LAN using ring topology and the TOKEN PASSING access mode is proposed. Finally, the proposed LAN is specified in terms of topology and its LAN access interface. Author

63 CYBERNETICS

Includes feedback and control theory, artificial intelligence, robotics and expert systems.

For related information see also *54 Man/System Technology and Life Support.*

N87-28331 Minnesota Univ., Minneapolis.
ADAPTIVE CONTROL VIA ENERGY EXCHANGE Ph.D. Thesis
Zahir Hashemi 1987 150 p
Avail: Univ. Microfilms Order No. DA8709557

The energy exchange concept from the pi-sharing theory and the dissipativity theory are used to derive stable adaptive control systems. Two types of adaptive control systems have been considered. The first is the stability supervisor-type adaptive mechanism where the adaptive algorithm measures the relative stability of the overall system, and makes the necessary adjustment on the gain of controller if the stability requirement is violated due to disturbance. The stability of this adaptive mechanism holds for poorly defined plants where the plant is defined only by a nonlinear operator. The stability conditions derived are strong in the sense that they are l(infinity)-stable. It is shown that, using the energy exchange method, the usual strictly positive assumptions on the noise parameter can be eliminated for the asymptotic stability of the self-tuning algorithm. For the overall stability of the adaptive system, the usual persistent excitation requirement of the plant input signal is enough. Also, a variable forgetting-factor scheme is introduced that could replace the persistent excitation requirement of the input signal. A special case of the self-tuning controller, which is the minimum variance regulator, is considered in the presence of mismatching stable poles between the actual plant and the estimated model. This adaptive system is found to be stable with the usual persistent excitation condition on the input

signal. Hence, in spite of the fact that the self-tuning controller design is based on exact model matching, the adaptive control still can be stable in the presence of certain unmodelled dynamics. Dissert. Abstr.

N87-28332# European Space Agency, Paris (France).
PARTIAL DISTURBANCE DECOUPLING WITH CONSTANT STATE FEEDBACK: APPLICATION TO THE REGULATOR PROBLEM
Reinhold Steinhauser Jan. 1987 38 p Transl. into ENGLISH of Teil-Stoerentkoppliung mit Konstanter Zustandsvektor-rueckfuehrung; Anwendung beim Regulatorproblem (Oberpfaffenhofen, West Germany, DFVLR), Jan. 1986 Original language document was announced as N86-33080
(ESA-TT-1003; DFVLR-FB-86-09; ETN-87-90008) Avail: NTIS HC A03/MF A01; original German version available from DFVLR, Cologne, West Germany DM 14.50

The geometrical approach to control theory is demonstrated for the simple disturbance decoupling problem. From the known conditions for the solution of the disturbance decoupling problem (without and with internal stability) necessary and sufficient conditions for the solution of problems of partial disturbance decoupling are deduced. It is shown that the regulator problem can be simplified if partial disturbance decoupling is possible. ESA

N87-28333*# College of William and Mary, Williamsburg, Va. Dept. of mathematics.
A SOFTWARE TOOLBOX FOR ROBOTICS Final Report
J. C. Sanwal 14 Oct. 1985 10 p
(Grant NAG1-533)
(NASA-CR-181267; NAS 1.26:181267) Avail: NTIS HC A02/MF A01 CSCL 09B

A method for programming cooperating manipulators, which is guided by a geometric description of the task to be performed, is given. For this a suitable language must be used and a method for describing the workplace and the objects in it in geometric terms. A task level command language and its implementation for concurrently driven multiple robot arm is described. The language is suitable for driving a cell in which manipulators, end effectors, and sensors are controlled by their own dedicated processors. These processors can communicate with each other through a communication network. A mechanism for keeping track of the history of the commands already executed allows the command language for the manipulators to be event driven. A frame based world modeling system is utilized to describe the objects in the work environment and any relationships that hold between these objects. This system provides a versatile tool for managing information about the world model. Default actions normally needed are invoked when the data base is updated or accessed. Most of the first level error recovery is also invoked by the database by utilizing the concepts of demons. The package can be utilized to generate task level commands in a problem solver or a planner. Author

N87-28334*# College of William and Mary, Williamsburg, Va. Dept. of Computer Science.
A SOFTWARE TOOLBOX FOR ROBOTICS Final Report
W. L. Bynum 14 Oct. 1985 11 p
(Grant NAG1-533)
(NASA-CR-181266; NAS 1.26:181266) Avail: NTIS HC A02/MF A01 CSCL 09B

A system of programs was developed to simulate the concurrent command/response interaction between a parallel jaw end effector and the LISP program controlling it. The overall structure of the simulation system was described in a paper submitted to the IEEE Conference on Automation and Robotics. A user's guide for the system was written. A line numbering program on the VAX (Pascal), a program for aiding in file transfer from the VAX to an LSI11 over the RTNET (FORTRAN), and a file scanning program (a crude SCAN) for the LSI11 (FORTRAN) were also developed. For individual titles, see N87-28335 through N87-28335.

N87-28335*# College of William and Mary, Williamsburg, Va. Dept. of Computer Science.
CONCURRENT SIMULATION OF A PARALLEL JAW END EFFECTOR
Bill Bynum *In its* A Software Toolbox for Robotics 14 Oct. 1985 p 5-11 (For primary document see N87-28334 22-63)
Avail: NTIS HC A02/MF A01 CSCL 09B

A system of programs developed to aid in the design and development of the command/response protocol between a parallel jaw end effector and the strategic planner program controlling it are presented. The system executes concurrently with the LISP controlling program to generate a graphical image of the end effector that moves in approximately real time in response to commands sent from the controlling program. Concurrent execution of the simulation program is useful for revealing flaws in the communication command structure arising from the asynchronous nature of the message traffic between the end effector and the strategic planner. Software simulation helps to minimize the number of hardware changes necessary to the microprocessor driving the end effector because of changes in the communication protocol. The simulation of other actuator devices can be easily incorporated into the system of programs by using the underlying support that was developed for the concurrent execution of the simulation process and the communication between it and the controlling program. Author

N87-28336# Technische Hogeschool, Eindhoven (Netherlands).
NUMERICAL SOLUTION OF OPTIMAL CONTROL PROBLEMS WITH STATE CONSTRAINTS BY SEQUENTIAL QUADRATIC PROGRAMMING IN FUNCTION SPACE Ph.D. Thesis
Kees Caspert Peter Machielsen 1987 225 p
(ETN-87-90242) Avail: NTIS HC A10/MF A01

An iterative descent method for optimal control problems where the direction of search is determined by the solution of a subproblem with quadratic objective function and linear constraints is presented. In each iteration a step size is determined using an exact penalty (merit) function. The application of the abstract method to state constrained optimal control problems is complicated by the fact that the subproblems, which are optimal control problems with quadratic objective function and linear constraints, cannot be solved easily when the structure of the solution is not known. A modification of the subproblems is necessary. As a result the method does not converge to a solution of the problem, but to a point close to a solution. A second stage using the structure of the solution determined in the first stage is necessary to determine the solution more accurately. The numerical implementation of the method is the solution of a linear multipoint boundary value problem. Numerical results of the program for practical problems are given. ESA

N87-28337# Pacific Northwest Labs., Richland, Wash.
THE APPLICATION OF EXPERT SYSTEMS TO THE ANALYSIS OF LOGIC TREES
A. L. Franklin Jun. 1987 13 p Presented at the Personal Computer Applications in the Gas Industry, Chicago, Ill., 22 Jun. 1987
(Contract DE-AC06-76RL-01830)
(DE87-011994; PNL-SA-14976; CONF-870657-1) Avail: NTIS HC A02/MF A01

Fault trees are a subject of logic trees. An application developed for the US Bureau of Mines uses artificial intelligence techniques to improve the availability of information contained in logic tree representations. FALTS (Failure Analysis and Logic Tree System) is a generalized knowledge-based system package designed to organize, identify, and communicate logic tree information. FALTS has been developed to provide a forum for investigating and preserving information describing the interdependencies of system components and subcomponents. The basic premise behind FALTS is that the representation and analysis of component dependencies can be standardized while specific dependency information can vary from system to system. The processing abilities of FALTS gives it the appearance of a logic tree analyst expert. Given a sufficient system description, FALTS is capable of identifying the

logical pathways leading to a particular event, the base events involved in any particular pathway, and the sequence of events that would result from the occurrence of a particular combination of base events. It is intended that FALTS be used as a predictive system for interfacing mine safety officials with the status and potential circumstances of mine operations. However, FALTS has been generalized to be used outside the mining industry. DOE

N87-28338# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EXACTLY SOLVING THE WEIGHTED TIME-FUEL OPTIMAL CONTROL OF AN UNDAMPED HARMONIC OSCILLATOR
Marcelo LopesdeO.eSouza Jun. 1987 9 p Presented at the 6th Brazilian Conference on Automatic Control, Belo Horizonte, Brazil, 25-28 Nov. 1986
(INPE-4201-PRE/1082) Avail: NTIS HC A02/MF A01

The exact solution of the weighted time-fuel optimal control of an undamped harmonic oscillator with one bounded control and any initial state is summarized. Its motivation is the possibility of improvements on the final behavior of trajectories produced by Vander Velde's designs for on-off controls of large space structures, by replacing his approximate solution (used there) by the exact one. Author

N87-28266# Harvard Univ., Cambridge, Mass. Dept. of Statistics.
UNCERTAIN EVIDENCE AND ARTIFICIAL ANALYSIS
A. P. Dempster and Augustine Kong *In* Stanford Univ., Workshop on Assessing Uncertainty held in Monterey, California on 13-14 November 1986 16 Mar. 1987 17 p (For primary document see N87-28265 22-59)
(Contracts N00014-85-K-0496; DAAL03-86-K-0042)
(AD-P005292; RR-S-108) Avail: NTIS HC A13/MF A01 CSCL 09B

N87-28268# SRI International Corp., Menlo Park, Calif. Artificial Intelligence Center.
AUTOMATING ARGUMENT CONSTRUCTION
John D. Lowrance *In* Stanford Univ., Workshop on Assessing Uncertainty held in Monterey, California on 13-14 November 1986 16 Mar. 1987 20 p (For primary document see N87-28265 22-59)
(Contracts N00039-83-K-0656; DAAL02-85-C-0082)
(AD-P005294) Avail: NTIS HC A13/MF A01 CSCL 09B

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N87-28339*# New Orleans Univ., La. Dept. of Physics.
OPTIMAL APPLICATION OF MORRISON'S ITERATIVE NOISE REMOVAL FOR DECONVOLUTION Semiannual Status Report
George E. Ioup and Juliette W. Ioup 30 Nov. 1986 19 p
(Grant NAG1-485)
(NASA-CR-180290; NAS 1.26:180290) Avail: NTIS HC A02/MF A01 CSCL 12A

Morrison's iterative method of noise removal can be applied for both noise removal alone and noise removal prior to deconvolution. This method is applied to noise of various noise levels added to determine the optimum use of the method. The phase shift method of migration and modeling is evaluated and the results are compared to Stolt's approach. A method is introduced by which the optimum iterative number for deconvolution can be found. Statistical computer simulation is used to describe the optimum use of two convergent iterative techniques for seismic data. The Always-Convergent deconvolution technique was applied to data recorded during the quantitative analysis of materials through NonDestructive Evaluation (NDE) in which ultrasonic signals were used to detect flaws in substances such as composites. B.G.

N87-28340# Naval Surface Weapons Center, Dahlgren, Va.
NSWC (NAVAL SURFACE WEAPONS CENTER) LIBRARY OF MATHEMATICS SUBROUTINES
Alfred H. Morris, Jr. Apr. 1987 452 p Supersedes NSWC/TR-84-143, AD-A155767
(AD-A181312; NSWC/TR-86-251; NSWC/TR-84-143) Avail: NTIS HC A20/MF A01 CSCL 12A

The NSWC library is a library of general-purpose FORTRAN subroutines that provide a basic computational capability in a variety of mathematical activities. Emphasis is placed on the transportability of the codes. Subroutines are available in the following areas: Elementary Operations, Geometry, Special Functions, Polynomials, Vectors, Matrices, Large Dense Systems of Linear Equations, Banded Matrices, Sparse Matrices, Eigenvalues and Eigenvectors, I sub 1 Solution of Linear Equations, Banded Matrices, Sparse Matrices, Least-Squares Solution of Linear Equations, Optimization, Transforms, Approximation of Functions, Curve Fitting, Surface Fitting, Manifold Fitting, Numerical Integration, Integral Equations, Ordinary Differential Equations, Partial Differential Equations, and Random Number Generation. Author (GRA)

N87-28341# Lawrence Livermore National Lab., Calif.
SOME NEW RESULTS USING QUADRATIC FINITE ELEMENTS FOR PURE ADVECTION
J. E. Rowley and P. M. Gresho May 1987 13 p Presented at the 6th IMACS International Symposium on Computer Methods for Partial Differential Equations, Bethlehem, Pa., 23 Jun. 1987
(Contract W-7405-eng-48)
(DE87-009849; UCRL-96615; CONF-870677-6) Avail: NTIS HC A02/MF A01

Presented is a study of the one-dimensional (1-D) advection equation. The authors present results in three areas. First, analytic solutions are given to the difference equations generated by the application of the Galerkin finite element method (GFEM) with piecewise linear basis functions (LFEM) (which solution has the same form as that for a space-centered second-order finite difference method), and piecewise quadratic (QFEM) basis functions for periodic boundary conditions and a uniform mesh. Second, based on these first results, a resolution is given to the question of the existence of the so-called backward traveling spurious mode in the case of QFEM. Third, the numerical behavior is examined for various solution methods on a randomly non-uniform mesh. DOE

N87-28342# Los Alamos National Lab., N. Mex.
THE ABEL INTEGRAL EQUATION
V. Faber and G. M. Wing Jun. 1987 49 p
(Contract W-7405-eng-36)
(DE87-010840; LA-11016-MS) Avail: NTIS HC A03/MF A01

Many noninvasive laboratory experiments lead to mathematical models involving the Abel integral equation. An example of such an experiment is presented and then two classical ways of obtaining the solution to the Abel equation described. Numerical implementation of this solution is often unsatisfactory because approximate differentiation of experimental data is required. An alternative approach based on the singular value decomposition is outlined and a brief description of a numerical algorithm based on this approach is given. A computer program employing this algorithm is used to solve three test problems. The results are presented graphically. DOE

N87-28343# Centre d'Etudes et de Recherches, Toulouse (France). Dept. d'Etudes et de Recherches en Informatique.
FINITE ELEMENT SOLUTION OF NAVIER-STOKES EQUATIONS Final Report [RESOLUTION PAR ELEMENTS DES EQUATIONS DE NAVIER-STOKES COMPRESSIBLES]
Daniel Kalfon and Dominique Volpert Jan. 1986 82 p In FRENCH
(Contract DRET-85-002)
(CERT-1/3245/DERI; ETN-87-90131) Avail: NTIS HC A05/MF A01

A finite element Navier-Stokes computer program with an algorithmic approach is described. The solution uses four sided

finite elements and assumes steady flow. The method is used for two dimensional flow with arbitrary geometry. It is shown that accurate results are obtained in the case of low Reynolds transonic flow examples. ESA

N87-28344# Technische Univ., Berlin (West Germany). Fachbereich 3 Mathematik.
FREDHOLM EQUATIONS FOR THE THREE-PARTICLE RESOLVER OF SCHROEDINGER OPERATORS WITH LONG RANGE POTENTIALS Ph.D. Thesis [FREDHOLMGLEICHUNGEN FUER DIE 3-TEILCHEN-RESOLVENTE VON SCHROEDINGER-OPERATOREN MIT LANGREICHWEITIGEN POTENTIALEN]
Stefan Knabe 1987 78 p In GERMAN
(ETN-87-90021) Avail: NTIS HC A05/MF A01

The resolver of a three-particle Hamilton operator was investigated to deduce the scattering amplitudes for three-particle scattering processes. The case of long range potentials, to which the Coulomb potential belongs, was considered, with a limitation to negative global energy. Starting from the Faddeev equations for short range potentials, Fredholm equations on suitable Banach spaces were derived for the resolver. It is shown that these equations can be solved if no bound state exists for the corresponding energy. The equations conserve their Fredholm property after the transition to the real axis. ESA

N87-28345# Freie Univ., Berlin (West Germany). Inst. fuer Mathematik.
A CONSERVATIVE, UNCONDITIONALLY STABLE, SECOND ORDER THREE-POINT DIFFERENCE SCHEME FOR THE DIFFUSION-CONVECTION EQUATION
Christophe Clauser (Technische Univ., Berlin, West Germany) and Stefan Kiesner 1986 22 p
(Grant DFG-Be-331/17-3)
(Preprint-246/86; ETN-87-90365) Avail: NTIS HC A02/MF A01

A three point differencing scheme for the diffusion-convection equation that offers the advantages of the central and the one-sided (upwind) differencing scheme without their drawbacks is presented. The scheme is conservative, unconditionally stable, and second order accurate in space. It is free of oscillations and over or undershoots, simple to code, and requires no more computing time than the one-sided scheme. The scheme can be used to model hydrothermal systems and contaminant transport in the geosciences. The scheme is compared with a widely used one-sided scheme for the transient diffusion-convection equation in different time discretizations. The results are encouraging. ESA

N87-28346*# Brown Univ., Providence, R. I.
RESEARCH ON COMPUTATIONAL FLUID DYNAMICS AND TURBULENCE Semiannual Report
[1986] 80 p
(Grant NAG1-703)
(NASA-CR-180304; NAS 1.26:180304) Avail: NTIS HC A05/MF A01 CSCL 12A

Preconditioning matrices for Chebyshev derivative operators in several space dimensions; the Jacobi matrix technique in computational fluid dynamics; and Chebyshev techniques for periodic problems are discussed. For individual titles, see N87-28347 through N87-28348.

N87-28347*# Brown Univ., Providence, R. I.
PRECONDITIONING MATRICES FOR CHEBYSHEV DERIVATIVE OPERATORS
Ernest E. Rothman *In its* Research on Computational Fluid Dynamics and Turbulence [1986] 19 p (For primary document see N87-28346 22-64)
Avail: NTIS HC A05/MF A01 CSCL 12A

The problem of preconditioning the matrices arising from pseudo-spectral Chebyshev approximations of first order operators is considered in both one and two dimensions. In one dimension a preconditioner represented by a full matrix which leads to preconditioned eigenvalues that are real, positive, and lie between 1 and pi/2, is already available. Since there are cases in which it is not computationally convenient to work with such a preconditioner, a large number of preconditioners were studied which were more sparse (in particular three and four diagonal matrices). The eigenvalues of such preconditioned matrices are compared. The results were applied to the problem of finding the steady state solution to an equation of the type u sub t = u sub x + f, where the Chebyshev collocation is used for the spatial variable and time discretization is performed by the Richardson method. In two dimensions different preconditioners are proposed for the matrix which arises from the pseudo-spectral discretization of the steady state problem. Results are given for the CPU time and the number of iterations using a Richardson iteration method for the unpreconditioned and preconditioned cases. Author

N87-28348*# Brown Univ., Providence, R. I.
THE JACOBI MATRIX TECHNIQUE IN COMPUTATIONAL FLUID DYNAMICS Ph.D. Thesis
H. Thomas Sharp *In its* Research on Computational Fluid Dynamics and Turbulence [1986] 59 p (For primary document see N87-28346 22-64)
Avail: NTIS HC A05/MF A01 CSCL 12A

The Jacobi matrix technique was applied to the direct calculation of inviscid supersonic flow about two dimensional airfoils of varying thickness, angle of attack and camber and axisymmetric bodies of varying thickness and taper; and the design (inverse) calculation of inviscid supersonic flow past airfoils described by a given family of pressure distributions and axisymmetric bodies described by a given family of pressure distributions. The method was also applied to subsonic potential flow about two dimensional airfoils by modifying Jameson's FLO36. Results are discussed. B.G.

N87-28349# Texas Univ., Austin.
COUPLING BOUNDARY INTEGRAL AND FINITE ELEMENT FORMULATIONS FOR NONLINEAR HALFSPACE PROBLEMS
M. Stern and L. M. Taylor 1987 11 p Presented at the IUTAM Symposium on Advanced Boundary Element Methods, San Antonio, Tex., 13 Apr. 1987 Prepared in cooperation with Sandia National Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(DE87-010735; SAND-87-1114C; CONF-8704141-1) Avail: NTIS HC A02/MF A01

In finite element applications involving static or quasistatic nonlinear inelastic response in unbounded regions, there is the question of how to truncate the region to be modeled and how to select appropriate boundary conditions to be imposed on the remote boundary. Typically such problems are modeled by placing the exterior boundary far enough away so that the effect of fixing the boundary does not significantly alter the stress and deformation in areas of interest. There are two drawbacks to this approach. First, there is always some effect no matter how far away the boundary is placed, which makes it difficult for the analyst to judge precisely how much effect his choice of the location of the boundary is having on the solution. The second and perhaps more important drawback is that the boundary must be placed so far away from regions of interest that an unnecessarily large number of elements must be used, which increases the computational cost of the analysis. A promising alternative is to use an exterior boundary integral representation to calculate a boundary stiffness for the exterior region which can then be coupled to the finite element formulation in the interior region. This boundary stiffness scheme has been implemented in two explicit finite element codes which are widely used at Sandia for plane and axisymmetric quasistatic finite element analyses: JAC which uses a conjugate gradient method in the iterative solution of the finite element equations, and SANCHO which relies on dynamic relaxation. The boundary integral application is applied to halfspace problems and its numerical implementation is described. DOE

N87-28350# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A PSEUDOPOLYNOMIAL TIME ALGORITHM FOR LINEAR DIOPHANTINE EQUATIONS
Nei Yoshihiro Soma and Horacio Hideki Yanasse Feb. 1987 20 p Presented at the 8th Congresso Nacional de Matematica Aplicada e Computacional, Florianopolis, Brazil, 1985
(INPE-4133-PRE/1044) Avail: NTIS HC A02/MF A01

A pseudopolynomial algorithm for linear diophantine equations based on the calculation of the rank of the Mignosi's matrix is presented. The use of a sufficient test that insures the existence of a solution which is based on Paoli's theorem is also emphasized. Author

N87-28351# Johns Hopkins Univ., Baltimore, Md. Dept. of Electrical Engineering and Computer Science.
OBLIQUE PROJECTIONS: FORMULAS, ALGORITHMS, AND ERROR BOUNDS Interim Report, 1 May 1985 - 2 Feb. 1987
Selahattin Kayalar and Howard L. Weinert 2 Jun. 1987 29 p
(Contract N00014-85-K-0255)
(AD-A181914; JHU/ECE-87/10) Avail: NTIS HC A03/MF A01 CSCL 12A

When an orthogonal projection is to be computed using data acquired by distributed sensors, it is often necessary to process each sensor's data locally and then transmit the results to a central facility for final processing. The most efficient way to do this is to compute oblique projections locally. This choice makes the final processing a matter of summing the oblique projections. This paper derives new formulas, and iterative algorithms and associated error bounds, for oblique projections in arbitrary Hilbert spaces. GRA

N87-28352# Brown Univ., Providence, R. I. Center for Dynamical Systems.
SPLINE-BASED PARAMETER ESTIMATION TECHNIQUES FOR TWO-DIMENSIONAL CONVECTION AND DIFFUSION EQUATIONS
L. L. Zia Jul. 1986 54 p
(Grants NSF MCS-85-04316; AF-AFOSR-0398-84)
(AD-A181925; LCDS-TR-86-46; AFOSR-87-0799TR) Avail: NTIS HC A04/MF A01 CSCL 12A

A general approximation framework based on bicubic splines is developed for estimating temporally and spatially varying parameters in two-dimensional convection and diffusion equations derived from mass transport theory. The parameter estimation problem is first cast as an abstract infinite dimensional minimization problem. Then a sequence of approximate, finite dimensional problems is defined, which yields a sequence of parameter estimates. Convergence results relating the approximate problems to the full infinite dimensional problem are presented, as well as a discussion addressing computer implementation. Finally, the technique is applied to the analysis of actual biological data from an insect dispersal experiment, in which the movement of cabbage root flies in the presence of a cabbage crop was studied. It is proposed that such a parameter estimation method can be a useful analytical tool to help develop appropriate models in population biology. GRA

N87-28353# Pittsburgh Univ., Pa. Inst. for Computational Mathematics and Applications.
ITERATIVE SOLUTIONS OF SPARSE LINEAR SYSTEMS ON SYSTOLIC ARRAYS
Rami Melhem Mar. 1987 24 p
(Contract N00014-85-K-0339; Grant AF-AFOSR-0131-84)
(AD-A182111; ICMA-87-105) Avail: NTIS HC A02/MF A01 CSCL 12A

The idea of grouping the non-zero elements of a sparse matrix into a few strips that are almost parallel is applied to the design of a systolic accelerator for sparse matrix operations. This accelerator is, then, integrated into a complete systolic system for the solution of large sparse linear systems of equations. The design demonstrates that the application of systolic arrays is not limited to regular computations, and that computationally irregular problems may be solved on systolic networks if local storage is provided in each systolic cell for buffering the irregularity in the data movement and for absorbing the irregularity in the computation. GRA

N87-28354# Ballistic Research Labs., Aberdeen Proving Ground, Md.
AN APPLICATION OF THE FINITE ELEMENT METHOD TO MAXIMUM ENTROPY TOMOGRAPHY IMAGE RECONSTRUCTION Technical Report, 1984 - 1986
Robert T. Smith and Csaba K. Zoltani 7 Apr. 1987 28 p
(AD-A182146; AD-E900674; BRL-TR-2795) Avail: NTIS HC A03/MF A01 CSCL 06E

A new approach to maximum entropy tomographic image reconstruction is considered here. It is shown that by using a finite dimensional subspace of L sub 2 (D), one can obtain an approximation to the solution of a maximum entropy optimization problem, set in L sub 2 (D). Several examples of appropriate finite element subspaces for a 2-dimensional parallel beam projection geometry are examined. Particular attention is paid to the case where the X-ray projection data is sparse. In the current work, this means that the number of projections or views is small (in practice, perhaps only 15 to 20, as compared with the 180 views used in modern medical CAT scanners). A priori information in the form of known maximum and minimum densities of the materials being scanned is built into the model. A penalty function, added to the entropy term, is used to control the residual error in meeting the projection measurements. GRA

N87-28355# Georgia Inst. of Tech., Atlanta. Production and Distribution Research Center.
ON A NODE RANKING PROBLEM OF TREES AND GRAPHS
Ananth V. Iyer, H. D. Ratliff, and G. Vijayan 24 Oct. 1986 14 p
(Contract N00014-86-K-0173)
(AD-A182315; PDRC-87-03) Avail: NTIS HC A02/MF A01 CSCL 12A

We discussed a problem about ranking nodes of a graph, which is a restriction of the general graph coloring problem. A graph is said to have number k if its vertices can be ranked using integers 1,...,k such that if two nodes have the same rank i, there is a node with rank greater than i on every path between the two nodes. We give an O(n log n) algorithm for optimal ranking of trees, and also present bounds on the rank number for trees, planar and other graph classes. GRA

N87-28356# Naval Surface Weapons Center, Silver Spring, Md.
STABILITY LIMITS OF MODIFIED HILBER-HUGHES ALGORITHM FOR TIME INTEGRATION IN DYNAMIC ANALYSIS
Minos Moussouros Aug. 1986 138 p
(AD-A182603; NSWC/TR-86-324) Avail: NTIS HC A07/MF A01 CSCL 12A

This report extends the range of unconditional stability of a modified form of the implicit method of Hilber-Hughes. The stability analysis is applicable only to the uncoupled linear modal equations. Tables and curves are presented for a convenient choice of the involved parameters. GRA

N87-28357*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ENO SCHEMES WITH SUBCELL RESOLUTION Final Report
Ami Harten Aug. 1987 63 p Submitted for publication
(Contract NAS1-18107)
(NASA-CR-178362; ICASE-87-56; NAS 1.26:178362) Avail: NTIS HC A04/MF A01 CSCL 12A

The notion is introduced of subcell distribution, which is based on the observation that unlike point values, cell-averages of a discontinuous piecewise-smooth function contain information about the exact location of the discontinuity within the cell. Using this observation an essentially non-oscillatory (ENO) reconstruction technique is designed which is exact for cell averages of discontinuous piecewise-polynomial functions of the appropriate degree. Later on this new reconstruction technique is incorporated into Godunov-type schemes in order to produce a modification of

the ENO schemes which prevents the smearing of contact discontinuities. Author

N87-28358*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE CONVERGENCE OF SPECTRAL METHODS FOR NONLINEAR CONSERVATION LAWS Final Report
Eitan Tadmor Aug. 1987 24 p
(Contract NAS1-18107)
(NASA-CR-178352; ICASE-87-54; NAS 1.26:178352) Avail: NTIS HC A02/MF A01 CSCL 12A

The convergence of the Fourier method for scalar nonlinear conservation laws which exhibit spontaneous shock discontinuities is discussed. Numerical tests indicate that the convergence may (and in fact in some cases must) fail, with or without post-processing of the numerical solution. Instead, a new kind of spectrally accurate vanishing viscosity is introduced to augment the Fourier approximation of such nonlinear conservation laws. Using compensated compactness arguments, it is shown that this spectral viscosity prevents oscillations, and convergence to the unique entropy solution follows. Author

N87-28359# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A PLANAR SOLUTION PROCEDURE FOR LINEAR DIOPHANTINE EQUATIONS
Nei Yoshihiro Soma and Horacio Hideki Yanasse Jun. 1987 21 p Presented at the ORSA/TIMS Meeting, St. Louis, Mo., 26-28 Oct. 1987
(INPE-4205-PRE/1082) Avail: NTIS HC A02/MF A01

A planar procedure for solving linear diophantine equations based on the calculation of the rank of the Mignosi's matrix is presented. A procedure for improving the bound on a linear diophantine problem of Frobenius is suggested. Author

N87-28360# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Lab. Associado de Computacao e Matematica Aplicada.
INVERSION OF HIGHER-ORDER MATRIX EQUATIONS THROUGH THE COMPUTING OF THEIR DYNAMICAL SOLUTIONS
Julio Cesar RuizClaeyssen, Elisabeta Gallicchio, and Marco Tulio Vilhena (Universidade Federale do Rio Grand do Sul, Porto Alegre, Brazil) Jun. 1987 16 p
(INPE-4183-PRE/1072) Avail: NTIS HC A02/MF A01

Matrix finite difference equations and ordinary differential equations are discussed in terms of the Green function for initial value problems. Explicit formulas are derived by using the Laplace-Stieltjes transform. A formula for inverting a matrix polynomial is also obtained. Author

N87-28361# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
STATE ESTIMATORS FOR DYNAMIC SYSTEMS BASED UPON THE DUALITY CONCEPT Ph.D. Thesis - Polytechnical College of USP, Oct. 1985 [ESTIMADORES DE ESTADO DE SISTEMAS DINAMICOS BASEA DOS NO CONCEITO DE DUALIDADE]
Agenor deToledoFleury Mar. 1987 200 p In PORTUGUESE; ENGLISH summary
(INPE-4142-RPE/539) Avail: NTIS HC A09/MF A01

The development of a new state estimator for dynamic systems based upon the duality concept between state estimation and optimal control problems is presented. The main objective is a preliminary qualification of the estimator for use in real time nonlinear systems which can recursively be approximated by linear systems. The duality concept is used to transform the original estimation problem in an equivalent one of virtual control. This control problem is then used to generate an adaptive, locally convergent algorithm where, instead of full state estimation, one has to estimate just a control vector with smaller dimension than the state vector. The control formulation allows also the development of convergence acceleration criteria. Three convergence criteria, as well as adaptive noise methods to compensate for model errors, are then developed and used with the proposed estimator in the test problem created to validate the estimator. The algorithm is implemented in a digital computer to estimate the orbit of a low Earth orbit satellite under simulated conditions. Numerical results include various test cases to take account for different initial values for the estimator, different standard deviations for the observations and different number of Earth stations observing the satellite, thus allowing a good evaluation for the estimator characteristics. Author

N87-28362# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
COMPUTATIONAL ASPECTS OF REAL TIME SYSTEMS M.S. Thesis [ASPECTOS COMPUTACIONAIS DE SISTEMAS DE TEMPE REAL]
Masao Murata Apr. 1987 151 p In PORTUGUESE; ENGLISH summary
(INPE-4157-TDL/269) Avail: NTIS HC A08/MF A01

Computers have been used in real time process control and monitoring in the various application areas. A strong dependency between the processes and the respective computer systems have required that special care be taken in the requirement analysis and in the hardware and software definition for the development of these systems. This dissertation describes the relevant hardware and software topics with respect to real time process control in a broad manner, as well as discusses some of these topics in more detail. The influence of computer architecture, communication system, programming mechanisms supports, programming language, and other topics on the real time system composition are discussed. Author

N87-28363# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
APPLICATIONS OF MATHEMATICAL MORPHOLOGY [APLICACOES DA MORFOLOGIA MATEMATICA]
Junior Barrera, Nelson D. A. Mascarenhas, and Gerald Jean F. Banon Apr. 1987 18 p In PORTUGUESE; ENGLISH summary Presented at the 7th Congress of the Brazilian Society of Computation, and 14th SEMISH, Integrated Seminar on Software and Hardware, Salvador, BA, 11-19 Jul. 1987 Submitted for publication
(INPE-4143-PRE/1050) Avail: NTIS HC A02/MF A01

Some applications of mathematical morphology algorithms to the treatment and analysis of images are presented. The processing algorithms were performed on the morphological image analysis system (ANIMA), developed by the basic research group at the Image Processing Department (DPI) of INPE. Author

N87-28364# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DETERMINATION OF GAUSSIAN PEAKS IN GAMMA-RAY SPECTRA BY ITERATIVE REGRESSION [DETERMINACAO POR REGRESSAO ITERATIVA DE PICOS GAUSSIANOS EM ESPECTROS GAMA]
Daniel Jean Roger Nordemann 22 May 1987 13 p In PORTUGUESE; ENGLISH summary Prepared for presentation at the 2nd Regional Geophysical Meeting (SBGf), Nov. 1987
(INPE-4174-PRE/1069) Avail: NTIS HC A02/MF A01

The parameters of the peaks shown in gamma-ray spectra may be determined by a simple iterative regression method. For each peak, the parameters determined are associated with a Gaussian curve (3 parameters) located above a linear continuum (2 parameters). This method may be used instead of much more complicated ones; furthermore, it gives the complete results of the calculation of statistical uncertainties and a precision higher than that which is given by simpler methods. Author

N87-28365*# Houston Univ., Tex. Dept. of Mechanical Engineering.
FINITE ELEMENT SOLUTION TECHNIQUES FOR LARGE-SCALE PROBLEMS IN COMPUTATIONAL FLUID DYNAMICS Interim Report
J. Liou and T. E. Tezduyar Jul. 1987 72 p

(Contract NAS9-17380)
(NASA-CR-172004; NAS 1.26:172004) Avail: NTIS HC A04/MF A01 CSCL 12A

Element-by-element approximate factorization, implicit-explicit and adaptive implicit-explicit approximation procedures are presented for the finite-element formulations of large-scale fluid dynamics problems. The element-by-element approximation scheme totally eliminates the need for formation, storage and inversion of large global matrices. Implicit-explicit schemes, which are approximations to implicit schemes, substantially reduce the computational burden associated with large global matrices. In the adaptive implicit-explicit scheme, the implicit elements are selected dynamically based on element level stability and accuracy considerations. This scheme provides implicit refinement where it is needed. The methods are applied to various problems governed by the convection-diffusion and incompressible Navier-Stokes equations. In all cases studied, the results obtained are indistinguishable from those obtained by the implicit formulations.
Author

N87-28366*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A HYBRID PERTURBATION GALERKIN TECHNIQUE WITH APPLICATIONS TO SLENDER BODY THEORY Final Report
James F. Geer and Carl M. Andersen (College of William and Mary, Williamsburg, Va.) Aug. 1987 58 p Submitted for publication
(Contract NAS1-18107; NCC1-40)
(NASA-CR-178354; ICASE-87-55; NAS 1.26:178354) Avail: NTIS HC A04/MF A01 CSCL 12A

A two step hybrid perturbation-Galerkin method to solve a variety of applied mathematics problems which involve a small parameter is presented. The method consists of: (1) the use of a regular or singular perturbation method to determine the asymptotic expansion of the solution in terms of the small parameter; (2) construction of an approximate solution in the form of a sum of the perturbation coefficient functions multiplied by (unknown) amplitudes (gauge functions); and (3) the use of the classical Bubnov-Galerkin method to determine these amplitudes. This hybrid method has the potential of overcoming some of the drawbacks of the perturbation method and the Bubnov-Galerkin method when they are applied by themselves, while combining some of the good features of both. The proposed method is applied to some singular perturbation problems in slender body theory. The results obtained from the hybrid method are compared with approximate solutions obtained by other methods, and the degree of applicability of the hybrid method to broader problem areas is discussed.
Author

N87-28367*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EXPERIMENTS IN ENCODING MULTILEVEL IMAGES AS QUADTREES
Donald L. Lansing Sep. 1987 60 p
(NASA-TP-2722; L-16292; NAS 1.60:2722) Avail: NTIS HC A04/MF A01 CSCL 12A

Image storage requirements for several encoding methods are investigated and the use of quadtrees with multigray level or multicolor images are explored. The results of encoding a variety of images having up to 256 gray levels using three schemes (full raster, runlength and quadtree) are presented. Although there is considerable literature on the use of quadtrees to store and manipulate binary images, their application to multilevel images is relatively undeveloped. The potential advantage of quadtree encoding is that an entire area with a uniform gray level may be encoded as a unit. A pointerless quadtree encoding scheme is described. Data are presented on the size of the quadtree required to encode selected images and on the relative storage requirements of the three encoding schemes. A segmentation scheme based on the statistical variation of gray levels within a quadtree quadrant is described. This parametric scheme may be used to control the storage required by an encoded image and to preprocess a scene for feature identification. Several sets of black and white and pseudocolor images obtained by varying the segmentation parameter are shown.
Author

N87-28273# George Mason Univ., Fairfax, Va.
ON RANDOMNESS, DETERMINISM AND COMPUTABILITY
Edward J. Wegman *In* Stanford Univ., Workshop on Assessing Uncertainty held in Monterey, California on 13-14 November 1986 16 Mar. 1987 21 p (For primary document see N87-28265 22-59)
(AD-P005300; TR-7) Avail: NTIS HC A13/MF A01 CSCL 12A

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N87-28368# Netherlands Energy Research Foundation, Petten.
TREATMENT OF MEASUREMENT UNCERTAINTIES
Willem L. Zijp Jan. 1987 128 p
(ECN-194; B8701493; ETN-87-90180) Avail: NTIS HC A07/MF A01

The concepts of error, uncertainty, bias, precision, accuracy, expectation, moments, variance, standard deviation, and statistical weight are reviewed. The propagation of random and systematic uncertainties; and the concepts of covariance and correlation are discussed. The formulas for the propagation of variances and covariances are considered. The generalized least squares method is outlined. Problems which can arise when covariance matrices are constructed from incomplete and/or inappropriate experimental data are treated.
ESA

N87-28369# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
INEXACT REASONING IN EXPERT SYSTEMS: AN INTEGRATING OVERVIEW
R. J. P. Groothuizen Jan. 1986 23 p Revised
(Contract RB-RLD-1985:2.1/VZ)
(NLR-TR-86009-U; ETN-87-90183) Avail: NTIS HC A02/MF A01

Methods for modeling uncertainty in expert systems are discussed. Theories such as fuzzy sets, belief functions, possibility distributions, approximate and plausible reasoning, and multivalued logics are compared with probability theory. Application of these theories may be difficult because it may be hard to specify the fuzzy operations and it may be hard to keep the results meaningful and interpretable after longer chains of reasoning. Given this state of the art it is recommendable not to abandon probability theory at once in favor of the alternative theories.
ESA

N87-28370# Stanford Univ., Calif. Dept. of Statistics.
ON CONSECUTIVE-k-OUT-OF-n: F SYSTEMS
Fung-Yee Chan, Lai K. Chan, and Gwo D. Lin 11 May 1987 25 p
(Contract N00014-86-K-0156)
(AD-A181916; TR-389) Avail: NTIS HC A02/MF A01 CSCL 12A

A consecutive-k-out-of-n: F system consists of n lineraly ordered components and the system fails if and only if at least k consecutive components fail. This type of system has attracted considerable attention since 1980. In this paper first a brief survey of the literature is given. Then the system is studied in the general case when the n components are statistically independent, but may not have the same reliability. Most of the papers in the literature use traditional combinatorial or conditional probability approaches to derive the formulae for the system reliability. Here the authors show that using the elegant and concise algebraic approach and network diagram representation given in Chapters 1 and 2 of Barlow and Proschan (1975), one can easily obtain the exact formula for the system reliability. Furthermore, they are able to obtain algorithms for finding all the minimal path sets and cut sets of

the system, and hence the upper and lower bounds of the system reliability. A simplified upper bound is also proposed. GRA

N87-28371# Texas A&M Univ., College Station. Dept. of Statistics.
KERNEL ESTIMATION OF THE DERIVATIVE OF THE REGRESSION FUNCTION USING REPEATED-MEASUREMENTS DATA
D. B. Holiday and Jeffrey D. Hart Jun. 1987 42 p
(Contract N00014-85-K-0723)
(AD-A182141; TR-4) Avail: NTIS HC A03/MF A01 CSCL 12A

In fixed design kernel nonparametic regression, there has been a paucity of results for models which allow for correlated errors. Consider repeated measurements models, applicable in growth curve analysis. It is assumed that the matrix elements may be represented as the product of a scalar variance term and a suitably restricted correlation function. Asympototic expansions of the mean squared error of the Gasser Mueller kernel estimator of an arbitrary pth derivation of g are obtained for two general classes of correlation functions. Consistency and other results based on such expansions are discussed for orders p=1 and p=2. GRA

N87-28372# Texas A&M Univ., College Station. Dept. of Statistics.
CONSIDERATIONS FOR THE LINEAR ESTIMATION OF A REGRESSION FUNCTION WHEN THE DATA ARE CORRELATED
D. B. Holiday, T. E. Wehrly, and Jeffrey D. Hart Jun. 1987 86 p
(Contract N00014-85-K-0723)
(AD-A182151; TR-3) Avail: NTIS HC A05/MF A01 CSCL 12A

A repeated-measurements model applicable in growth curve analysis, with correlated errors within subjects is developed. Kernel estimators of the population regression function are examined for various correlation functions. Limiting forms of an optimal linear combination of the subject means are derived. Conditions for consistency of a general linear estimator are stated for the Ornstein-Uhlenbeck correlation function and a more general covariance structure. A numerical study investigating the requisite amount of smoothing and the efficiency of four popular kernel estimators is carried out. The expected values of the estimators are compared against one another and against an optimal linear combination. GRA

N87-28373# Stanford Univ., Calif.
SMOOTHNESS PRIORS IN TIME SERIES
Will Gersch and Genshiro Kitagawa 2 Jun. 1987 56 p
(Contracts N00014-86-K-0156; N00014-83-K-0238)
(AD-A181903; TR-391) Avail: NTIS HC A04/MF A01 CSCL 12A

A variety of time series signal extraction/smoothing problems are considered from a Bayesian smoothness priors point of view. The origin of the subject is a smoothing problem posed by Wittaker (1923). Using a stochastic regression-linear model-Gaussian disturbances framework, we model stationary time series and nonstationary covariance and nonstationary mean time series. Smoothness priors distributions on the model parameters are expressed either in terms of time domain stochastic difference equation or frequency domain constants. A small number of (hyper) parameters specify very complex time series behavior. The critical computation is the likelihood of the Bayesian model. Finally we show a smoothness priors state space - not necessarily Gaussian - not necessarily linear model of nonstationary time series. GRA

N87-28374# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Ministerio da Ciencia e Tecnologia.
BRIEF INTRODUCTION IN STATISTICAL PATTERN RECOGNITION [BREVE INTRODUCAO AO RECONHECIMENTO ESTATISTICO DE PADROES]
Nelson DelfinoDAvilaMascarenhas Jul. 1987 14 p In PORTUGUESE; ENGLISH summary Presented at the 39th Annual Conference of SBPC, Symposium on Artificial Intelligence, Brasilia, Jul. 1987
(INPE-4206-PRE/1087) Avail: NTIS HC A02/MF A01

A brief description of the main techniques of statistical pattern recognition is presented. The discussed topics comprise: feature extraction, statistical classification, learning methods, and clustering. The main problems tackled presently in the area of natural resources detection are also presented. Author

N87-28267# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Statistics.
APPROXIMATING BELIEF FUNCTIONS IN A RULE-BASED SYSTEM
William F. Eddy *In* Stanford Univ., Workshop on Assessing Uncertainty held in Monterey, California on 13-14 November 1986 16 Mar. 1987 21 p (For primary document see N87-28265 22-59)
(Contract N00014-84-K-0588)
(AD-P005293) Avail: NTIS HC A13/MF A01 CSCL 12A

N87-28269# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Statistics.
A BAYESIAN VIEW OF ASSESSING UNCERTAINTY AND COMPARING EXPERT OPINION
Morris H. DeGroot *In* Stanford Univ., Workshop on Assessing Uncertainty held in Monterey, California on 13-14 November 1986 16 Mar. 1987 24 p (For primary document see N87-28265 22-59)
(Grant NSF DMS-83-20618)
(AD-P005295; TR-387) Avail: NTIS HC A13/MF A01 CSCL 12A

N87-28270# British Columbia Univ., Vancouver.
GROUP DEC'SION ANALYSIS AND ITS APPLICATION TO COMBINING OPINIONS
James V. Zidek *In* Stanford Univ., Workshop on Assessing Uncertainty held in Monterey, California on 13-14 November 1986 16 Mar. 1987 31 p (For primary document see N87-28265 22-59)
(Grant NSF MCS-83-01808)
(AD-P005296) Avail: NTIS HC A13/MF A01 CSCL 12A

N87-28272# Cornell Univ., Ithaca, N.Y. School of Electrical Engineering.
LOWER PROBABILITY MODELS FOR UNCERTAINTY AND NONDETERMINISTIC PROCESSES
Terrence L. Fine *In* Stanford Univ., Workshop on Assessing Uncertainty held in Monterey, California on 13-14 November 1986 16 Mar. 1987 36 p (For primary document see N87-28265 22-59)
(AD-P005299) Avail: NTIS HC A13/MF A01 CSCL 12A

N87-28274# Northwestern Univ., Evanston, Ill. Dept. of Statistics.
THE BAYESIAN ANALYSIS OF TESTIMONY
S. L. Zabell *In* Stanford Univ., Workshop on Assessing Uncertainty held in Monterey, California on 13-14 November 1986 16 Mar. 1987 44 p (For primary document see N87-28265 22-59)
(AD-P005301) Avail: NTIS HC A13/MF A01 CSCL 12A

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N87-28375# Lawrence Livermore National Lab., Calif.
CONTROL SYSTEM RESEARCH FOR DIRECTED ENERGY WEAPONS Annual Technical Report, FY86
K. D. Young, ed. Oct. 1986 539 p
(Contract W-7405-eng-48)
(DE87-005206; UCID-20950) Avail: NTIS HC A23

This report describes program progress in numerical algorithms for controls and robust control methods. Nine papers have been separately indexed. Additional information is presented in the report on the following topics: large scale systems control methods; multirate digital control; decentralized/regulated control methods; and mathematical modeling for flexible structures. DOE

N87-28376*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SWITCH USER'S MANUAL
1 Feb. 1987 130 p
(Contract NAS7-918)
(NASA-CR-181321; JPL-Publ-86-24; NAS 1.26:181321) Avail: NTIS HC A07/MF A01 CSCL 12B

The planning program, SWITCH, and its surrounding changed-goal-replanning program, Runaround, are described. The evolution of SWITCH and Runaround from an earlier planner, DEVISER, is recounted. SWITCH's plan representation, and its process of building a plan by backward chaining with strict chronological backtracking, are described. A guide for writing knowledge base files is provided, as are narrative guides for installing the program, running it, and interacting with it while it is running. Some utility functions are documented. For the sake of completeness, a narrative guide to the experimental discrepancy-replanning feature is provided. Appendices contain knowledge base files for a blocksworld domain, and a DRIBBLE file illustrating the output from, and user interaction with, the program in that domain. Author

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N87-28377# California Univ., Santa Barbara. Dept. of Mathematics.
MATRIX THEORY Annual Report, 1 Jul. 1986 - 30 Jun. 1987
Henryk Minc 30 Jun. 1987 5 p
(Contract N00014-85-K-0489)
(AD-A182264) Avail: NTIS HC A02/MF A01 CSCL 12B

Two areas of matrix theory are discussed: the theory of permanents, and the theory of nonnegative matrices. The first paper deals with permanental compounds and their use in recurrence formulas for permanents of (0,1)-circulants and in related asymptotic formulas. The second paper is an extensive survey of the progress in the theory of permanents achieved during the quadrennium 1982 to 1985. The last paper deals with the problem of determining the minimum permanent in the set of n x n doubly stochastic matrices whose first main diagonal entries are equal to zero. The case k = 0 is the famed van der Waerden conjecture. The case k = 1 can be easily solved by a method similar to that used by Egorycev in proving the van der Waerden conjecture. For k = 2 Egorycev's techniques are of limited use. The case was solved in 1984. For 3 less than or equal k less than or equal n the problem is still unsolved. GRA

N87-28271# San Francisco State Univ., Calif. Dept. of Mathematics.
SURVEY OF RESEARCH ON FUZZY SETS IN THE SOVIET UNION
Sergei V. Ovchinnikov *In* Stanford Univ., Workshop on Assessing Uncertainty held in Monterey, California on 13-14 November 1986 16 Mar. 1987 31 p (For primary document see N87-28265 22-59)
(AD-P005297) Avail: NTIS HC A13/MF A01 CSCL 12A

70 PHYSICS (GENERAL)

For precision time and time interval (PTTI) see *35 Instrumentation and Photography;* for geophysics, astrophysics or solar physics see *46 Geophysics, 90 Astrophysics,* or *92 Solar Physics.*

N87-28378# Joint Publications Research Service, Arlington, Va.
USSR REPORT: PHYSICS AND MATHEMATICS
17 Jun. 1987 82 p Transl. into ENGLISH from various Russian articles
(JPRS-UPM-87-007) Avail: NTIS HC A05/MF A01

Translations of Soviet books and journal articles are presented. This volume concerns itself with physics and mathematics. The subject areas are: acoustics; crystals, laser glasses and semiconductors; fluid dynamics; lasers; nuclear physics; optics and spectroscopy; plasma physics; superconductivity; technical physics; and theoretical physics. For individual titles, see N87-28379 through N87-28392.

N87-28379# Joint Publications Research Service, Arlington, Va.
MODE OF SOUND RADIATION DURING FORCED VIBRATIONS OF SHELLS IN COMPRESSIBLE FLUID Abstract Only **c71**
M. I. Guseyn-Zade *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 2-3 Transl. into ENGLISH from Prikladnaya Matematika i Mekhanika (Moscow, USSR), v. 50, no. 5, Sep. - Oct. 1986 p 876-880 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

Radiation of sound from a vibrating sphere through a compressible fluid completely surrounding it is analyzed as a problem of forced vibrations, on the basis of the corresponding Helmholtz equation for the displacement potential. The solution to this equation describes the displacement potential as a series in spherical functions and yields the sound intensity in the fluid as a polynomial function, with positive coefficients, of the inverse square of distance from the center of the sphere. The significance of lower power terms increases while the effect of compressibility decreases with increasing distance from the sphere, in a manner which depends on the wave number and thus on the frequency. Author

N87-28380# Joint Publications Research Service, Arlington, Va.
RESEARCH IN PHYSICS OF NARROW-BAND SEMICONDUCTORS AND THEIR USE AS BASIS FOR TUNABLE INFRARED INJECTION LASERS Abstract Only **c36**
A. P. Shotov *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 5 Transl. into ENGLISH from Vestnik Akademii Nauk SSSR (Moscow, USSR), no. 6, Jun. 1986 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

Research in the physics of narrow band (narrow gap) semiconductor compounds of group 4 and group 6 elements, particularly PbS, PbSe, PbTe, SnS, SnSe, SnTe, PbSnSe alone or in solid solutions, was conducted because of their suitability for infrared injection lasers. Their energy gaps varies over the 0 to 0.3 eV range, depending on the composition and their laser emission wavelength can be varied over the 3 to 40 micron range. Important factors are photoelectrical and optical characteristics of these materials, radiative recombination processes in them, and their energy spectra. Among lasers developed on this basis are continuous wave and pulsed ones with a low threshold current density of 25 A/sq cm at 10 K and 700 A/sq cm at 80 K temperatures, also 46 micron long wave lasers. A major application for these lasers are high resolution spectrometers for spectroscopy of molecules, chemical analysis of gases, identification of isotopes, etc. Other promising applications range from scientific ones such as tracking the effects of strong pulsed electric and magnetic fields on atoms and molecules to practical ones such as industrial product inspection, atmospheric pollution control, and optical data processing. Author

N87-28381# Joint Publications Research Service, Arlington, Va.
QUASI-RESONANCES IN PROBLEM OF FORCED VIBRATIONS FOR THIN ELASTIC SHELL INTERACTING WITH FLUID Abstract Only **c39**
D. G. Vasilyev and V. B. Lidskiy *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 16 Transl. into ENGLISH from Funktsionalnyy Analiz i Ego Prilozheniya (Moscow, USSR), v. 20, no. 4, Oct. - Dec. 1986 p 17-28 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

Forced three dimensional vibrations of a closed thin elastic shell filled with nonviscous compressible fluid is described by a system of four linear equations in operator form, with the shell thickness as small parameter and with Young's modulus of the shell material defined as a complex quantity E=E sub 0(1+i gamma) to account for internal friction characterized by the small positive gamma. The problem is simplified by extraction of the transient component and by assumptions according to V. Z. Vlasov: n sub pq=0 and p+q less than 6, coordinates p=1,2,3 and q=1,2,3. A theorem validating asymptotic expansion in powers of the relative shell thickness is proved with the aid of two lemmas, whereupon the problem is referenced to the corresponding Dirichlet eigenvalue problem. After asymptotic expansions were obtained for frequencies generally not equal to the Dirichlet eigenvalue and in a special case equal to it, quasi-resonances are sought within the 0 less than (omega sub min, omega sub max) frequency range. The necessary and sufficient condition for a quasi-resonance within this range is established by proof of the existence theorem, this condition being that at least one natural frequency of the shell or at least one eigenvalue of the corresponding Dirichlet problem lie within that frequency range. Author

N87-28382# Joint Publications Research Service, Arlington, Va.
FORMATION OF SHORT GIANT RADIATION PULSE IN YAG:Nd3+ LASER WITH UNSTABLE RESONATOR Abstract Only **c36**
Yu. L. Kokurin, N. Ye. Kuzmenko, V. M. Mizin, R. A. Petrenko, A. A. Statsenko, A. N. Sukhanovskiy, and N. Ya. Nedbayev *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 17 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 12, Dec. 1986 p 2541-2542 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

Formation of short giant radiation pulses in a YAG:Nd(3+) laser was studied in an experiment with Q-switching by means of a bleachable nickel dye in an organic solvent having a relaxation time of 1 ns. The laser crystal, between this shutter and a diaphragm with a hole 3 mm in diameter, was placed in a 200 mm long resonator cavity formed by two plane mirrors with a 100 percent and 15 percent reflection coefficient respectively. An identical cyrstal was used in a telescopic amplifier between two spherical mirrors with a 100 percent reflection coefficient each, a concave one reflecting into it the laser radiation and a convex one at the other end. Both crystals were 8 mm in diameter and 80 mm long. Laser and amplifier receiving mirror. The results of this experiment confirm the effectiveness of an unstable resonator as universal means of optimizing all laser pulse beam energy and time characteristics, pulses of 50 mJ energy and 2.5 ns duration in a beam with not more than 3 feet divergence and amplified to 400 mJ at a density of inverse population 4 times higher than the threshold for emission. Author

N87-28383# Joint Publications Research Service, Arlington, Va.
KINEMATIC MODE LOCKING IN CONTINUOUS-WAVE YAG:Nd3+ RING LASER Abstract Only **c36**
L. S. Kornishenko, T. V. Klykova, N. V. Kvartsov, V. A. Sidorov, A. M. Susov, and Yu. P. Yatsenko *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 18 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 12, Dec. 1986 p 2479-2485 Original language document was announced in IAA as A87-38292 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

The unidirectional and bidirectional modes of lasing of a ring laser are studied when the resonator perimeter is varied periodically with a frequency of 250 Hz and amplitude up to 250 microns. It is shown that the most favorable conditions for achieving mode locking in this laser arise with a perimeter variation due to the movement of one of the resonator mirrors. Calculations are performed which reveal the presence of minimal coupling during which the stability of the mode locking is preserved in the bidirectional lasing regime. Author

N87-28384# Joint Publications Research Service, Arlington, Va.
PARAELECTRODE EFFECTS IN PERIODIC-PULSE EXCIMER LASER Abstract Only **c36**
R. V. Arutyunyan, V. M. Borisov, A. Yu. Vinokhodov, Yu. B. Kiryukhin, and A. N. Morozov *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 19 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 12, Dec. 1986 p 2403-2407 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

An experimental study of a periodically pulsed XeCl laser was made, for the purpose of determining the dependence of discharge compression on the electrode material. Laser pulses of 0.5 J energy and 50 ns width at half amplitude were focused on the cathode within a 1 sq mm large spot through a lens with an f=30 cm focal length. The cathode was a disk made of duralumin carrying six pellets 1 cm in diameter of a different material each and uniformly spaced around a circle so that each alone could in turn be placed under the laser beam by rotation of the disk without the need to open and reclose the discharge chamber. Discharge in the 100 cu cm large chamber with helium under a pressure of 1.2 atm was produced, upon preionization by ultraviolet light, between this cathode and a reticular anode made of stainless steel with a T= 0.5 transmission coefficient. The time lag of the discharge pulse behind the incident laser pulse was measured and found to increase with increasing energy of the laser pulse in helium. These measurement as well as photographs of full volume and compressed discharge have revealed that materials requiring most heat for vaporization are most suitable for the cathode.
Author

N87-28385# Joint Publications Research Service, Arlington, Va.
HIGH-POWER LASER SET WITH PLATE-SHAPED AMPLIFIER ON NEODYMIUM GLASS GENERATING PICOSECOND PULSES AT REPETITION RATES UP TO 1 Hz Abstract Only **c36**
A. Varanavichyus, R. Grigonis, R. Danelyus, A. Piskarskas, and D. Podenas *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 20 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 12, Dec. 1986 p 2391-2395 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

A high power multistage laser set with neodymium phosphate glass as active medium and with optical pumping of all stages was designed, built, and tested. The oscillator stage with a glass rod 5 mm in diameter and 100 mm long in an elliptical luminaire and with an extractor of single pulses behind is followed by four amplifier stages: (1) glass rod 5 mm diam. and 100 mm long elliptical luminaire, (2) glass rod 6 mm diam. and 110 mm long elliptical luminaire, (3) glass rod 7 mm diam. and 140 mm long cylindrical luminaire, (4) glass plate 5 mm thick and 28x140 sq mm large between diffusely reflecting plates of MgO ceramic. The advantages of a plate over a cylinder with equal cross sectional area in the last amplifier stage are a much higher cooling rate and a negligible deplorization of linearly polarized light, except at the edges. The amplifier is followed by a 15 mm long KDP of crystal acting as second harmonic generator, with up to 40 percent conversion efficiency, and then a pair of 4 cm long KDP crystals with e-oe interaction as parametric generator in the output stage. With its design optimized, this laser set has the capacity to generate pulses of up to 40 mJ energy and approx. 3ps duration at a repetition rate of 1 Hz. Author

N87-28386# Joint Publications Research Service, Arlington, Va.
MOLECULAR PHOTODISSOCIATION LASER EMITTING BLUISH-GREEN LIGHT WITH ENERGY OF 3 J Abstract Only **c36**

S. L. Bazhulin, N. G. Basov, S. N. Burgimov, V. S. Zuyev, A. S. Kamrukov, N. P. Kozlov, A. G. Opekan, and Yu. S. Protasov *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 20 Transl. into ENGLISH from Pisma v Zhurnal Tekhnicheskoy Fiziki (Leningrad, USSR), v. 12, no. 23, 12 Dec. 1986 p 1423-1429 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

A photodissociation laser emitting in the 480 + or - 30 nm wavelength band was produced with HgBr2 vapor, by effective depletion of the lower (X) level after widened B-X ionic covalent transition through vibrational relaxation upon collisions of active HgBr2 molecules against atoms and molecules of the buffer gas. The advantages of HgBr2 over other media lasing bluish-green are larger cross sections for induced transitions and regenerability of active molecules so that high gain and periodically pulsed operation at a high repetition rate in a close cycle become realizable. The experiment was performed with wideband optical rather than conventional electric discharge pumping, with the 110 cm long laser chamber heated to 250 C and the optical pump inside the chamoer distributed over the middle 50 cm. The optical pump was a linearly stabilized glow discharge at the dielectric surface, the laser being periodically pulsed at repetition rates of 0.1 to 100 Hz with an energy varied over the 0.95 to 2.85 kJ range by artificial stimulation of breakdown wave processes in an Ar + N2 mixture with the aid of 3 to 9 mu F capacitors discharging from 25 kV. Author

N87-28387# Joint Publications Research Service, Arlington, Va.
EFFECT OF COHERENT PROCESSES ON LIGHT PULSES IN Ar+-LASER WITH ACTIVE MODE LOCKING Abstract Only **c36**

A. A. Apolonskiy *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 21-22 Transl. into ENGLISH from Optika i Spectroskopiya (Leningrad, USSR), v. 61, no. 4, Oct. 1986 p 898-900 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

A study of the Ar+ laser with active mode locking was made, involving radiation spectrum and pulseform analysis, for the purpose of scrutinizing the role of coherent processes. The inside channel of the discharge tube containing the active medium was formed by tungsten disks 3 mm in diameter, with the argon pressure varied over the 0.2 to 0.4 torr range at a discharge current of 30 A. The mean light intensity in the resonator cavity did not exceed 50 W/sq cm and the phase relaxation time T sub 2 remained within the 100 to 150 ps range, according to measurements at the ion temperature. The product of maximum attainable pulse duration t=50 ns and width of the frequency spectrum D=9 GHz corresponded quantitatively to a Gaussian pulseform. Oscillations along the pulse tails, observed when D greater than T sub 2 sup 1, are attributable to coherent interaction of light and the active medium. An increase of the pulse propagation velocity in the active medium, observed when t less than or equal to T sub 2, is attributable to coherent amplification. Both effects are limited by finiteness of the phase relaxation time and by radial nonuniformity of the radiation field. Author

N87-28388# Joint Publications Research Service, Arlington, Va.
EMISSION OF PICOSECOND PULSES BY HETEROJUNCTION INJECTION LASERS WITH Q-SWITCHING Abstract Only **c36**

Zh. I. Alferov, A. B. Zhurvalev, Ye. L. Portnoy, and N. M. Stelmakh *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 27-28 Transl. into ENGLISH from Pisma v Zhurnal Tekhnicheskoy Fiziki (Leningrad, USSR), v. 12, no. 18, 26 Sep. 1986 p 1093-1098 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

Emission characteristics of the AlGaAs/GaAs laser with a saturable absorber region for Q-switching were studied in an experiment, concerning the feasibility of stable spike emission. Saturable absorber regions in laser specimens were produced by deep implantation of oxygen ions in one mirror of the continuous stripe structure, rather than by its bombardment with protons, so as to avoid amorphization. Measurement of the power current characteristic revealed two groups of implanted lasers, the quantum efficiency of the first group decreasing sharply with increasing implantation dose and that of the second group remaining approximately constant. Emission pulses of 60 ps half width were detected by an InP(Fe) photoresistor. The true pulse duration, taking into account the resolution time of the instruments, was estimated by the autocorrelation method. The time interval between successive spikes on the autocorrelation curve corresponds to the time of double passage of photon through a Fabry-Perot resonator used with the laser diode, and their width corresponds to the spectral width of the envelope of laser emission modes.
Author

N87-28389# Joint Publications Research Service, Arlington, Va.
NUCLEAR MAGNETIC RESONANCE IN HEAVY-FERMION SUPERCONDUCTOR UBeSUB13 Abstract Only **c76**

N. Ye. Alekseyevskiy and Ye. G. Nikolayev *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 49-50 Transl. into ENGLISH from Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 91, no. 5(11), Nov. 1986 p 1820-1831 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

Anomalous properties of the heavy fermion compound UBe-13 with a cubic structure of the NaZn-13 kind were studied by the method of nuclear magnetic resonance, on Be-9 nuclei. The structure of this compound consists of U atoms and icosahedral Be-13 clusters with 1 Be-I atom at the center and 12 Be-II atoms at the vertices in each of 8 clusters. The compound becomes a superconductor at a temperature below 4.2 K, its magnetic susceptibility depending on the temperature in accordance with Curie's law in the high temperature range and ceasing to depend on the temperature below 4.2 K. A polycrystalline specimen was produced by fusion of U and Be in an induction furnace. It was crushed into powder and mixed with paraffin in an agate mortar. Single crystals were grown, also in an induction furnace, by slow cooling of the melt in a BeO crucible. The lattice constant of most specimens was 10.25 A and their superconducting transition temperature was 0.9 K, but for NMR measurements had been selected a single crystal with a lattice constant 10.254 A and their superconducting transition temperatue 0.55 K. Author

N87-28390# Joint Publications Research Service, Arlington, Va.
PROPERTIES OF ANISOTROPIC DISORDERED SUPERCONDUCTOR SYSTEM IN NORMAL METAL Abstract Only **c76**

L. G. Aslamazov, A. A. Dyachkov, and S. V. Lempitskiy *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 50 Transl. into ENGLISH from Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 91, no. 5(11), Nov. 1986 p 1776-1788 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

An array of superconducting fibers in a matrix of normal metal is considered, a disordered but unidirectionally oriented and thus strongly anisotropic array having a high lossless current carrying capacity in a strong electric field. First is calculated the critical current density for a system with small volume fraction of the superconducting phase, with a large ratio of distance, d, between fibers to coherence length zeta sub N and a correspondingly small superconduction current proportional to sup d/zeta N. Analysis of the relations in this case is based on the theory of streaming, fibers assumed to be thin with a cylindrical geometry. Next are determined the properties of a system with large volume fraction of superconducting fibers, above the critical 0.15 volume fraction and corresponding to formation of infinite clusters. The critical current density in this case is calculated for a single fiber and for a normal matrix of a plane parallel SNS sandwich, at temperatures above the critical point T sub c and then within the narrow transition range, without a magnetic field and then in a magnetic field.
Author

N87-28391# Joint Publications Research Service, Arlington, Va.
LECTURE DEMONSTRATIONS OF PROPERTIES OF SUPERCONDUCTORS AND LIQUID HELIUM Abstract Only **c76**
Ye. M. Gershenzon, G. N. Goltsman, A. I. Yelantyev, Ye. B. Petrova, N. G. Ptitsina, and V. S. Filatov *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 51 Transl. into ENGLISH from Fizika (Tomsk, USSR), v. 24, no. 7, Jul. 1986 p 110-112 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

New demonstrations for low temperature physics courses are described. Two transparent Dewar vacuum flasks fitting one inside the other with the external flask for nitrogen and the internal flask for helium are used. The helium temperature can be regulated in the 4.2 to 1.6 K range and the effects of reducing helium to the superfluid state at 2.17 K can be shown: boiling abruptly stops and superfluid flow appears. In order to show the electric and magnetic characteristics of superconductivity, a superconducting NbTi solenoid containing nonsuperconducting wire and germanium and superconducting Nb materials with different critical temperatures is placed in the helium refrigerant vessel. The fall of the resistance at the critical temperatures can be shown. In order to show magnetic field and superconductive current flow properties a shunt of superconductive material is connected in parallel to the coil and is enclosed in a teflon container with a heater which can vary its temperature. When it is heated and not superconductive, magnetic field effects can be demonstrated and when it is unheated and superconducting a continuous current can be demonstrated. Author

N87-28392# Joint Publications Research Service, Arlington, Va.
COMPOUND OPTOACOUSTIC GRAVITATIONAL ANTENNA Abstract Only **c32**
V. V. Kulagin, A. G. Polnarev, and V. N. Rudenko *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 52 Transl. into ENGLISH from Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 91, no. 5(11), Nov. 1986 p 1553-1564 Original language document was announced in IAA as A87-27576 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

Consideration is given to a gravitational antenna which contains acoustic and optical degrees of freedom. Expressions are obtained for the corresponding parts of a response to structurally different gravitational wave bursts. A calculation is made of the sensitivity of a long baseline interferometric antenna upon substitution of free test masses by Weber detectors. The sensitivity level at which this substitution is significant is determined. In particular, it is possible to detect metric perturbations (h) of about 10 to the -18th without deep cooling of the Weber detectors and of about 10 to the -19th to 10 to the -20th upon cooling to helium temperatures. The novel qualities of the combined antenna are discussed. Author

71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environmental Pollution*.

N87-28393# Sandia National Labs., Albuquerque, N. Mex.
ACOUSTIC WAVE DEVICES FOR SENSING IN LIQUIDS
S. J. Martin, A. J. Ricco, and R. C. Hughes 1987 5 p Presented at the 4th International Conference on Solid-State Sensors and Actuators, Tokyo, Japan, 2 Jun. 1987
(Contract DE-AC04-76DP-00789)
(DE87-007679; SAND-87-0716C; CONF-870676-2) Avail: NTIS HC A02/MF A01

Horizontally polarized shear waves (HPSWs) have been used for acoustic sensing of liquid viscosity and for measuring sub-monolayer mass changes accompanying electrode reactions. HPSWs are excited on a piezoelectric substrate using interdigital transducers in much the same fashion as the Rayleigh waves used in surface acoustic wave (SAW) sensors. HPSW sensors are shown to have several advantages compared to SAW devices and bulk crystal oscillators for liquid sensing. DOE

N87-28394# California Inst. of Tech., Pasadena. Dept. of Electrical Engineering.
ACOUSTOOPTIC PROCESSING OF TWO DIMENSIONAL SIGNALS USING TEMPORAL AND SPATIAL INTEGRATION Annual Report, 1 Sep. 1985 - 28 Feb. 1987
Demetri Psaltis, John Hong, Scott Hudson, Fai Mok, and Mark Neifeld 29 May 1987 89 p
(Grant AF-AFOSR-0332-85)
(AD-A181761; AFOSR-87-0776TR) Avail: NTIS HC A05/MF A01 CSCL 09F

Acoustooptic signal processing architectures and methods are developed for a variety of 2-D problems. A formulation of the universe synthetic aperture radar problem as an energy minimization procedure is reported. Acoustooptic systems for multiple target detection and 2-D spectrum analysis are experimentally demonstrated. The application of acoustooptics to the adaptive beam-forming for broadband antenna arrays is described. Author (GRA)

N87-28395 Technische Hogeschool, Delft (Netherlands).
DESIGN AND DEVELOPMENT OF A SYNTHETIC ACOUSTIC ANTENNA FOR HIGHLY DIRECTIONAL SOUND MEASUREMENTS Ph.D. Thesis
Rinus Boone 1987 199 p
(ISBN-90-9001647-3; ETN-87-90241) Copyright Avail: Issuing Activity

A SYNThetic ACoustic ANtenna (SYNTACAN) for highly directional sound measurements with an average resolving power of 1.5 deg in the frequency range from 89 to 1413 Hz (4 octave bands) with resolution of 1/12 octave, was developed for measurement of sound emissions from individual sources on industrial areas. The applicability of SYNTACAN is illustrated with a large number of test measurements concerning resolution, focussing, correlations, screening, and coherence loss. Measurements of sound from large factories, sound radiation from rotor blades of wind turbines, and the estimation of the source height of passing vehicles are described. Similarity between the imaging technique of SYNTACAN and techniques in optical and radioastronomy, sonar, radar, and seismology is discussed. The influence of the finite length of the antenna and the disturbance of the wave propagation by turbulence in the medium, causing finite beam patterns and thus unsharp source images is considered. ESA

N87-28396*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE EFFECT OF FRONT-TO-REAR PROPELLER SPACING ON THE INTERACTION NOISE OF A MODEL COUNTERROTATION PROPELLER AT CRUISE CONDITIONS
James H. Dittmar Aug. 1987 18 p
(NASA-TM-100121; E-3667; NAS 1.15:100121) Avail: NTIS HC A02/MF A01 CSCL 20A

The effect of front-to-rear propeller spacing on the interaction noise of a counterrotation propeller model was measured at cruise conditions. The data taken at an axial Mach number of 0.80 behaved as expected: interaction noise was reduced with increased spacing. The data taken at M=0.76 and M=0.72 did not behave as expected. At some of the test conditions the noise was unchanged; others even showed noise increases with increased spacing. A possible explanation, involving the amount of downstream blade area impacted by the tip vortex, is presented. Author

N87-28397# Texas Univ., Austin. Dept. of Mechanical Engineering.
PROBLEMS IN NONLINEAR ACOUSTICS: PARAMETRIC RECEIVING ARRAYS, FOCUSED FINITE AMPLITUDE SOUND, AND NONCOLLINEAR TONE-NOISE INTERACTIONS Annual Summary Report, 1 May 1986 - 1 Jul. 1987
Mark F. Hamilton 1 Jul. 1987 23 p

(Contract N00014-85-K-0708)
(AD-A182518; ASR-2) Avail: NTIS HC A02/MF A01 CSCL 17A

Three projects are discussed: (1) Parametric Receiving Arrays. This project is a theoretical investigation into the use of a parametric receiving array for directive measurements of noise radiated by ships in reverberant environments. The analysis is based on a Gaussian beam model that takes nearfield diffraction into account. The scattering of sound is also investigated; (2) Focused Finite Amplitude Sound. A numerical solution is used to investigate the combined effects of nonlinearity, diffraction, and absorption on sound that propagates through a focal region. The analysis yields time waveforms, axial propagation curves, spectral power distributions, and beam patterns; and (3) Noncollinear Tone-Noise Interactions. The noncollinear interaction of a pure tone and a band of noise that propagate in different modes of a rectangular duct is investigated both experimentally and theoretically. GRA

N87-28398*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CRUISE NOISE OF THE 2/9TH SCALE MODEL OF THE LARGE-SCALE ADVANCED PROPFAN (LAP) PROPELLER, SR-7A
James H. Dittmar and David B. Stang (Sverdrup Technology, Inc., Cleveland, Ohio.) Sep. 1987 52 p Prepared for presentation at the 11th AIAA Aeroacoustics Conference, Sunnyvale, Calif., 19-21 Oct. 1987
(NASA-TM-100175; E-3746; NAS 1.15:100175) Avail: NTIS HC A04/MF A01 CSCL 20A

Noise data on the Large-scale Advanced Propfan (LAP) propeller model SR-7A were taken in the NASA Lewis Research Center 8 x 6 foot Wind Tunnel. The maximum blade passing tone noise first rises with increasing helical tip Mach number to a peak level, then remains the same or decreases from its peak level when going to higher helical tip Mach numbers. This trend was observed for operation at both constant advance ratio and approximately equal thrust. This noise reduction or, leveling out at high helical tip Mach numbers, points to the use of higher propeller tip speeds as a possible method to limit airplane cabin noise while maintaining high flight speed and efficiency. Projections of the tunnel model data are made to the full scale LAP propeller mounted on the test bed aircraft and compared with predictions. The prediction method is found to be somewhat conservative in that it slightly overpredicts the projected model data at the peak. Author

N87-28379# Joint Publications Research Service, Arlington, Va.
MODE OF SOUND RADIATION DURING FORCED VIBRATIONS OF SHELLS IN COMPRESSIBLE FLUID Abstract Only
M. I. Guseyn-Zade *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 2-3 Transl. into ENGLISH from Prikladnaya Matematika i Mekhanika (Moscow, USSR), v. 50, no. 5, Sep. - Oct. 1986 p 876-880 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

N87-28399*# Institute for Scientific Research, Lexington, Mass.
MOLECULAR PROCESSES IN A HIGH TEMPERATURE SHOCK LAYER Final Technical Report, 1 May 1984 - 31 Jul. 1987
Steven L. Guberman 1987 7 p
(Contract NCC2-308)
(NASA-CR-180985; NAS 1.26:180985) Avail: NTIS HC A02/MF A01 CSCL 20H

Research was completed on several aspects of dissociative recombination (DR) for the molecules NO(+), N2(+), and O2(+). For O2(+), DR with an electron is described by, O2(+) + e(-) yields O + O. Model studies were completed of the windows arising in DR cross section from excited ion vibrational levels and of the variation of the DR cross section with the intersection point of the ion and neutral dissociative state potential curves. Author

N87-28400*# Old Dominion Univ., Norfolk, Va.
ABSORPTION CROSS-SECTIONS OF SODIUM DIATOMIC MOLECULES M.S. Thesis
Zeng-Shevan Fong Dec. 1985 77 p
(Grant NsG-1568)
(NASA-CR-180466; NAS 1.26:180466) Avail: NTIS HC A05/MF A01 CSCL 20H

The absorption cross sections of sodium dimers were studied using a heat pipe over operating in the non-heat-pipe mode. Three wavelength regions were observed. They are in the red, the green-blue, and the near ultraviolet regions. The absorption cross section depends on the wavelength of the incident light. Representative peak values for the v'=0 progression in the red and green-blue regions are 2.59 A sup 2 (average value) and 11.77 A sup 2 (T sub ave=624 K). The value for the C greater than X transitions is several tenths A sup 2. The cross sections were measured from absorption spectra taken as a function of temperature. Author

N87-28401# California Univ., Berkeley. Lawrence Berkeley Lab. Particle Data Group.
A GUIDE TO DATA IN ELEMENTARY PARTICLE PHYSICS
G. P. Yost, A. Rittenberg, B. Armstrong, M. Ferguson, Jr., B. S. Levine, K. H. Simpson, T. G. Trippe, M. J. Visser, G. S. Wagman, and C. G. Wohl Sep. 1986 590 p Prepared in cooperation with Stanford Univ.,Calif. and Gosudarstvennyi Komitet po Ispolzovaniyu AtomnoiEnergii, Serpukhov (USSR).
(Contracts DE-AC03-76SF-00098; DE-AC03-76SF-00515; Grant NSF PHY-83-18358)
(LBL-90-Rev) Avail: NTIS HC A25/MF A01

An indexed guide to experimental high energy physics literature is presented for the years 1977 through 1985. While no actual data are included, approximately 9,000 papers are indexed by Beam/Target/Momentum, Reaction/Momentum (including the final state), Particle, and Accelerator/Detector. All indices are cross referenced via an ID to the paper's title and references in the ID/Reference/Title index. Black marks at the side of the page enable each section to be located quickly, using the Table of Contents on the back cover. The information presented is also publicly available on a regularly updated SLAC-SPIRES database called DATAGUIDE. Author

N87-28402# Los Alamos National Lab., N. Mex.
A PRECISION TEST OF CHARGE INDEPENDENCE OF HADRONIC INTERACTIONS Ph.D. Thesis - Northwestern Univ., Evanston, Ill.
Marina Artuso Oct. 1986 194 p
(Contract W-7405-eng-36)
(LA-10834-T) Avail: NTIS HC A09/MF A01

Broken symmetries are among the richest sources of information about the fundamental interactions: the renewed interest in the study of isospin non-conservation by strong forces is closely related to the effort of understanding some properties of nuclear systems in terms of their basic degrees of freedom. The hope is to be able to relate the pattern of the dynamical breaking of this symmetry to the mass spectrum of light quarks: to this purpose a more detailed phenomenological knowledge must be provided by a new generation of experiments. A high precision test of charge independence of strong nuclear interactions was performed through the measurement of the ratio, R between the differential cross sections and the difference delta A(y0) between analyzing powers for the two reactions p + d yields H-3 + pi(+) and p + d yields He-3 + pi(0). The observable delta A(y0) is particularly relevant as it probes the spin dependent term of the symmetry breaking interaction, on which almost no empirical evidence is available. The experiment was performed using the N-type polarized proton beam (T sub p = 733 MeV), and detecting the charged heavy particle in the HRS magnetic spectrometer. The result for R is almost an order of magnitude more precise

than previous measurements, and the measurements for delta A(y0) have errors less than +/- 0.005, or approximately 1%.
M.G.

N87-28403*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A COMPUTER SYSTEM TO ANALYZE SHOWERS IN NUCLEAR EMULSIONS: CENTER DIRECTOR'S DISCRETIONARY FUND REPORT Final Report
C. A. Meegan, W. F. Fountain, and F. A. Berry, Jr. Aug. 1987 16 p
(NASA-TM-100310; NAS 1.15:100310) Avail: NTIS HC A02/MF A01 CSCL 20H

A system to rapidly digitize data from showers in nuclear emulsions is described. A TV camera views the emulsions though a microscope. The TV output is superimposed on the monitor of a minicomputer. The operator uses the computer's graphics capability to mark the positions of particle tracks. The coordinates of each track are stored on a disk. The computer then predicts the coordinates of each track through successive layers of emulsion. The operator, guided by the predictions, thus tracks and stores the development of the shower. The system provides a significant improvement over purely manual methods of recording shower development in nuclear emulsion stacks. Author

N87-28432*# College of William and Mary, Williamsburg, Va.
THE 200 MeV Pi+ INDUCED SINGLE-NUCLEON REMOVAL FROM 24Mg
Donald Joyce, Herbert O. Funsten, B. Joseph Lieb, Hans S. Plendl, Joseph Norton, Carey E. Stronach, V. Gordon Lind, Robert E. McAdams, O. Harry Otteson, and David J. Vieira (Los Alamos National Lab., N. Mex.) et al. *In* Virginia State Univ., (?)Activities of the Solid State Physics Research Institute 31 Dec. 1985 32 p (For primary document see N87-28430 22-76)
Avail: NTIS HC A04/MF A01 CSCL 20H

N87-28433*# Colorado Univ., Boulder. Nuclear Physics Lab.
THE 4He(p,d)3He REACTION AT 200 AND 400 MeV
P. W. F. Alons, J. J. Kraushaar, J. R. Shepard, J. M. Cameron, D. A. Hutcheon, R. P. Liljesttand, W. J. McDonald, C. A. Miller, W. C. Olsen, and J. R. Tinsley (Oregon Univ., Eugene.) et al. *In* Virginia State Univ., (?)Activities of the Solid State Physics Research Institute 31 Dec. 1985 9 p (For primary document see N87-28430 22-76)
Avail: NTIS HC A04/MF A01 CSCL 20H

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N87-28404# Oak Ridge National Lab., Tenn.
THE ROLE OF INTEGRAL EXPERIMENTS AND NUCLEAR CROSS SECTION EVALUATIONS IN SPACE NUCLEAR REACTOR DESIGN
D. L. Moses and R. D. McKnight 1987 5 p Presented at the 4th Symposium on Space Nuclear Power Systems, Albuquerque, N. Mex., 12 Jan. 1987 Prepared in cooperation with Argonne National Lab., Ill.
(Contract W-31-109-eng-38)
(DE87-007004; CONF-870102-2) Avail: NTIS HC A02/MF A01

The importance of the nuclear and neutronic properties of candidate space reactor materials to the design process has been acknowledged as has been the use of benchmark reactor physics experiments to verify and qualify analytical tools used in design, safety, and performance evaluation. Since June 1966, the Cross Section Evaluation Working Group (CSEWG) has acted as an interagency forum for the assessment and evaluation of nuclear reaction data used in the nuclear design process. CSEWG data testing has involved the specification and calculation of benchmark experiments which are used widely for commercial reactor design and safety analysis. These benchmark experiments preceded the issuance of the industry standards for acceptance, but the benchmarks exceed the minimum acceptance criteria for such data. Thus, a starting place has been provided in assuring the accuracy and uncertainty of nuclear data important to space reactor applications. DOE

N87-28405# Brookhaven National Lab., Upton, N. Y.
NUCLEAR PROPULSION SYSTEMS FOR ORBIT TRANSFER BASED ON THE PARTICLE BED REACTOR
J. R. Powell, H. Ludewig, F. L. Horn, K. Araj, R. Benenati, O. Lazareth, G. Slovik, M. Solon, W. Tappe, and J. Belisle (Grumman Aerospace Corp., Bethpage, N.Y.) et al. 1987 30 p Presented at the 4th Symposium on Space Nuclear Power Systems, Albuquerque, N. Mex., 12 Jan. 1987 Prepared in cooperation with Babcock and Wilcox Co., Lynchburg, Va. and Garrett Engine Co., Phoenix, Ariz.
(Contract DE-AC02-76CH-00016)
(DE87-010060; BNL-39695; CONF-870102-23) Avail: NTIS HC A03/MF A01

The technology of nuclear direct propulsion orbit transfer systems based on the Particle Bed Reactor (PBR) is described. A 200 megawatt illustrative design is presented for LEO to GEO and other high V missions. The PBR-NOTV can be used in a one-way mode with the shuttle or an expendable launch vehicle, e.g., the Titan 34D7, or as a two-way reusable space tug. In the one-way mode, payload capacity is almost three times greater than that of chemical OTV's. PBR technology status is described and development needs outlined. DOE

N87-28406# Netherlands Energy Research Foundation, Petten.
BEHAVIOR OF A SINGLE UO2 SPHERE, IRRADIATED AT APPROXIMATELY 1900 K IN THE HIGH FLUX REACTOR (HFR) AT PETTEN (THE NETHERLANDS)
A. vanderLinde Dec. 1986 35 p
(ECN-19; B8683254; ETN-87-90177) Avail: NTIS HC A03/MF A01

A UO2 sphere, with an as-fabricated diameter of 1.15 mm, an enrichment of 20% U-235 in U, and a density of 96% to 100% TD, was irradiated during 544 hr in a compacted bed of Al2O3 granules in an aluminum capsule placed in the D-8 core position of a fission reactor. Unexpected fission product release from a similarly irradiated sphere suggested that the achieved maximum temperature was beyond the 1100 K specified maximum. Axial gamma scanning of the capsule and microscopy of a cross section of the UO2 sphere indicate a maximum irradiation temperature of 1930 K. Evaluation of the measured fission products releases in relation to the calculated release contributions from fission product chain members emphasizes the release governing role of the volatile precursors of a by itself nonvolatile, radioactive, end member of a fission product chain. ESA

N87-28407# Netherlands Energy Research Foundation, Petten.
APPLICATION OF NOISE ANALYSIS IN FUEL PIN RESEARCH
E. Tuerkcan and J. E. DeVries Jan. 1987 36 p Presented at the 29th European Working Group on Irradiation Technology Plenary Meeting, Karlsruhe, West Germany, 24-26 Sep. 1986
(ECN-195; B8701494; ETN-87-90181) Avail: NTIS HC A03/MF A01

High flux reactor fuel pin irradiations were carried out as part of a transient overpower experiment. A simplified dynamic fuel pin model was applied and the experimental data are compared with model calculations. The heat transfer characteristics are determined using the transfer function between the neutron flux fluctuations (assumed to be proportional to those of the heat source) and the temperature fluctuations. Good agreement is reached and the experimental response functions can be interpreted in terms of the thermal fuel pin characteristics. It is shown how noise analysis contributes to the analysis of the fuel pin behavior under operating conditions. ESA

N87-28408# Argonne National Lab., Ill.
ASSESSMENT OF RADIOISOTOPE HEATERS FOR REMOTE TERRESTRIAL APPLICATIONS
K. L. Uherka May 1987 7 p Presented at the 22nd Intersociety Engery Conversion Engineering Conference, Philadelphia, Pa., 10 Aug. 1987
(Contract W-31-109-eng-38)
(DE87-011386; CONF-870804-18) Avail: NTIS HC A02

This paper examines the feasibility of using radioisotope byproducts for special heating applications at remote sites in Alaska and other cold regions. The investigation included assessment of candidate radioisotope materials for heater applications, identification of the most promising cold region applications, evaluation of key technical issues and implementation constraints, and development of conceptual heater designs for candidate applications. Strontium-90 (Sr-90) was selected as the most viable fuel for radioisotopic heaters used in terrestrial applications. Opportunities for the application of radioisotopic heaters were determined through site visits to representative Alaska installations. Candidate heater applications included water storage tanks, sludge digesters, sewage lagoons, water piping systems, well-head pumping stations, emergency shelters, and fuel storage tank deicers. Radioisotopic heaters for water storage tank freeze-up protection and for enhancement of biological waste treatment processes at remote sites were selected as the most promising applications. DOE

N87-28409# Stanford Linear Accelerator Center, Calif.
VARIATIONAL METHODS FOR FIELD THEORIES Ph.D. Thesis
Shahar Ben-Menahem Sep. 1986 113 p
(Contract DE-AC03-76SF-00515)
(SLAC-302) Avail: NTIS HC A06/MF A01

The thesis is presented in four parts dealing with field theory models: Periodic Quantum Electrodynamics (PQED) in (2+1) dimensions, free scalar field theory in (1+1) dimensions, the Quantum XY model in (1+1) dimensions, and the (1+1) dimensional Ising model in a transverse magnetic field. The last three parts deal exclusively with variational methods; the PQED part involves mainly the path integral approach. The PQED calculation results in a better understanding of the connection between electric confinement through monopole screening, and confinement through tunneling between degenerate vacua. Free field theory is used as a laboratory for a new variational blocking truncation approximation, in which the high frequency modes in a block are truncated to wave functions that depend on the slower background model (Born Oppenheimer approximation). For the XY model, several trial wave functions for the ground state are explored, with an emphasis on the periodic Gaussian. In the 4th part, the transfer matrix method is used to find a good (non blocking) trial ground state for the Ising model in a transverse magnetic field in (1+1) dimensions. Author

74 OPTICS

Includes light phenomena; and optical devices.
For lasers see *36 Lasers and Masers.*

N87-28410# NKF Engineering, Inc., Reston, Va.
FIBER OPTIC ENGINEERING SENSOR SYSTEM, DESIGN REVIEW REPORT
Apr. 1987 4 p
(Contract N00014-87-C-2032)
(AD-A181774; NKF-7103-001/3) Avail: NTIS HC A02/MF A01 CSCL 20F

A meeting was held to present orally the findings and recommendations contained in the FOESS Phase 1 Preliminary Design Review Data Package, for formal review by NRL. The ray paths shown represent displacement effects only. Because the spherical mirror acts as a lens, capturing all of the propagating modes emanating from the fiber and imaging them onto the mirror, there is no modal dependence. Imaging increases alignment dependence requiring the use of misalignment insensitive designs, e.g., HAML. There is presently no specific data on the performance of the HAML since it is a concept design only. The temperature dependence of the GACPV's force-to-displacement transfer function can be reduced or eliminated by selecting a sufficiently large force constant for the optical diaphram. Gases making the transducer suitable for operation over large temperature ranges would be identified during design and construction. The key-term Good does not mean that a particular transducer will meet a MIL-Spec. The terms used in the table are relative only to the four candidate transducers included and are derived from realistic assessments of their potential qualities. Construction and testing is necessary to verify the comparisons. GRA

N87-28411# Technische Hogeschool, Eindhoven (Netherlands).
A STUDY OF REACTION MECHANISMS IN PLASMAS RELATED TO GLASS-FIBER PRODUCTION Ph.D. Thesis
Ludovicus Henricus Saes 1987 186 p
(ETN-87-90245) Avail: NTIS HC A09/MF A01

Use of the fertilizer industry waste product SiF4 for the manufacturing of optical fibers for telecommunication is discussed. The SiF4 can be obtained from H2SiF6, a by-product of the manufacturing process. A relatively simple distillation procedure can be used to remove impurities such as HF and the (salts of the) transition metals. After purification, SiF4 might be a proper raw material for production of solar grade silicon (photovoltaic cells) or pure quartz (optical fibers). However, application of SiF4 in a flame burner of chemical vapor deposition process is not feasible on thermodynamic grounds. In plasma processes, a sooty deposit is formed, and efficiency is a factor of 20 less compared with SiCl4. The reaction mechanisms in SiF4-O2 and SiCl4-O2 discharges were studied to explain this difference. ESA

N87-28412# Martin Marietta Labs., Baltimore, Md.
IR LIQUID SWITCH, VOLUME 1 Final Report, 18 Apr. 1984 - 31 Jul. 1986
Wenpeng Chen, Claude Frazier, and Jar-Mo Chen Oct. 1986 34 p
(Contract DAAK70-84-C-0022)
(AD-A182020; MML-TR-86-85C-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 20F

In recent years, nonlinear optical materials having large nonlinear optical coefficients when combined with novel optical mechanisms have found many applications in the field of phase conjugation, image processing, optical computing, and optical switching. We have analyzed two dynamic nonlinear optical effects, artificial Kerr and photothermal, and reviewed two nonlinear phenomena, self-defocusing and nonlinear interface. The generic results are discussed. GRA

N87-28413# Naval Research Lab., Washington, D.C.
ANALYSIS AND EXPERIMENTAL IMPLEMENTATION OF OPTICAL BEAMFORMERS
Richard D. Griffin, Peter B. Rolsma, and John N. Lee 20 May 1987 53 p
(AD-A182129; NRL-MR-5995) Avail: NTIS HC A04/MF A01 CSCL 09E

Most modern beamformers are implemented on a digital computer. This report examines the potential for analog optical beamforming systems to meet the proposed requirements. The report lists various beamforming algorithms and their calculational complexity; a list of the strengths and weaknesses of digital implementations is also included. Various general algorithms for time and frequency domain optical beamforming are then described. Special emphasis is placed on the importance of designing efficient interfaces between analog optical and electronic systems and digital systems. Details of three implementations of optical beamformers are presented: cross bar and partial sum time domain beamformers, and a vector matrix frequency domain beamformer. Without further research it is not possible to determine the maximum practical capability of an optical beamformer, but frequency domain optical beamforming systems look promising for systems requiring large numbers of beams. The experimental optical vector matrix processor has been designed, constructed, and configured to

perform frequency domain beamforming at a rate of 2 x 10 to the 9th power 8-bit multiples/sec. It also is likely that optical beamformers can meet the low power and size requirements in certain applications such as on board processing for sonobuoys employing hydrophone arrays: an architecture has been developed with potential power consumption of less than 20mW. GRA

N87-28414# Naval Ocean Systems Center, San Diego, Calif.
ULTRA-WIDEBAND DIRECTION FINDING USING FIBER OPTIC TRANSVERSAL FILTERS Final Report, Oct. 1984 - Sep. 1986
S. A. Pappert Mar. 1987 69 p
(AD-A182281; NOSC/TR-1161) Avail: NTIS HC A04/MF A01 CSCL 17C

This report describes a wideband electro-optic direction finding (DF) processor using an array of laser diodes, an array of photodetectors, and a network of fiber optic delay lines. This DF filter offers a potential operational bandwidth in excess of 10 GHz and allows for multiple, simultaneous beam angular responses with peaks that are independent of frequency. Two eight-laser, two-transversal filter laboratory test model DF devices, one using multimode optical fiber and the other single-mode fiber, were constructed. These experimental matched-delay filters are operable in the 200- to 1800- systems' sensitivity, dynamic range, angular resolution, and frequency response. It is concluded from theoretical and experimental results obtained in this investigation that the multitude DF device is slightly superior in performance to the single-mode system due to the higher throughput optical power levels possible with multimode systems. Further, it is concluded that the fiber optics matched-delay filter can be a useful device for ultra-wideband direction finding. Author (GRA)

N87-28415# California Inst. of Tech., Pasadena. Dept. of Electrical Engineering.
INTEGRATED OPTICAL INFORMATION PROCESSING Final Report, 30 Sep. 1985 - 31 Dec. 1986
Demetri Psaltis and David Brady 21 May 1987 22 p
(Grant AF-AFOSR-0339-84)
(AD-A182339; AFOSR-87-0850TR) Avail: NTIS HC A02/MF A01 CSCL 20F

The goal of this project is the development of techniques that will permit integrated optical devices to be used in inherently nonplanar optical information processing architectures. As a first demonstration of this method an integrated optical synthetic aperture radar processor is being developed. More general image processing operations are achievable in integrated optics form using the time and space integrating processing method. An architecture is presented that can perform an arbitrary linear transformation on an image provided the transformation has a kernel that is separable in the two coordinates. The possibility of photorefractively recording in the waveguide the signals that are necessary to specify the linear transformation using control beams that are external to the plane of the waveguide is explored. Initial experimental demonstration of this idea is reported and an integrated optical vector matrix multiplier that is based on this concept is proposed. GRA

N87-28416* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
METHOD AND APPARATUS FOR MAKING AN OPTICAL ELEMENT HAVING A DIELECTRIC FILM Patent
Gordon C. Augason, inventor (to NASA) 4 Aug. 1987 9 p
Filed 15 Aug. 1985 Supersedes N86-20128 (23 - 10, p 1670)
(NASA-Case-ARC-11611-1; US-Patent-4,684,424;
US-Patent-Appl-SN-765981; US-Patent-Class-156-163;
US-Patent-Class-156-229; US-Patent-Class-156-286;
US-Patent-Class-156-382; US-Patent-Class-156-494;
US-Patent-Class-264-291) Avail: US Patent and Trademark Office CSCL 20F

A film-application device (FAD) comprising a pair of exterior, tapered, O-ring bearing plate members and a central plate member for simplifying the process of thermally bonding a thin dielectric film to a substrate comprising an optical element are discussed. In use, the film is sandwiched between the O rings and stretched across the optical element by squeezing the exterior plates together before bonding to the element. The film may be used for protecting the optical element or to reduce surface reflection of radiation. The FAD may also be used without the center plate to stretch a dielectric film prior to its attachment to or insertion in a holder to make pellicles or beam-splitters.
Official Gazette of the U.S. Patent and Trademark Office

N87-28417*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass. Dept. of Electrical Engineering.
FIBER OPTICS: A RESEARCH PAPER
Melinda M. Drone 7 Aug. 1987 32 p
(Contract NAS9-17560)
(NASA-CR-181113; NAS 1.26:181113) Avail: NTIS HC A03/MF A01 CSCL 20F

Some basic aspects concerning fiber optics are examined. Some history leading up to the development of optical fibers which are now used in the transmission of data in many areas of the world is discussed. Basic theory of the operation of fiber optics is discussed along with methods for improving performance of the optical fiber through much research and design. Splices and connectors are compared and short haul and long haul fiber optic networks are discussed. Fiber optics plays many roles in the commercial world. The use of fiber optics for communication applications is emphasized. Author

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N87-28418*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
THE ROLE OF PLASMA WAVE TURBULENCE IN THE FORMATION OF SHOCK WAVES IN COLLISIONLESS PLASMAS Final Report
M. M. Mellott 1 Sep. 1987 10 p
(Grant NAG5-570)
(NASA-CR-181218; NAS 1.26:181218) Avail: NTIS HC A02/MF A01 CSCL 20I

A data set containing measurements for approximately 100 shock crossings was compiled, and plasma wave profiles were plotted in conjunction with magnetic field data. Three emissions analyzed include upstream electron plasma oscillations, ion acoustic noise, and low frequency electromagnetic noise. The data demonstrate that the observed waves are consistent with generation by the kinetic cross-field streaming instability. Reanalysis of shock overshoots prompted by the presence of plasma feet upstream of nominally subcritical shocks leads to the conclusion that no firm evidence exists for a sharp subcritical supercritical transition. Electron plasma oscillations persist up to the ramps of subcritical shocks and begin decaying at the front edge of the feet of supercritical shocks. Their intensity is anticorrelated with the amplitude of the foot ion acoustic noise. Wave measurements support the predicted predominance of lower hybrid-like modes over ion acoustic noise in the production of resistive (plasma) heating. Evidence for variable shock normal angles is seen upstream from nominally quasiparallel shocks. The first cases of very strong electron heating observed at the terrestrial bow shock were discovered. J.P.B.

N87-28419# California Univ., Los Angeles. Center for Plasma Physics and Fusion Engineering.
AN ANALYTIC MODEL FOR FLOW REVERSAL IN DIVERTOR PLASMAS
P. I. H. Cooke and A. K. Prinja Apr. 1987 20 p
(Contract DE-FG03-86ER-52130)
(DE87-010023; UCLA/PPG-1053) Avail: NTIS HC A02/MF A01

An analytic model is developed and used to study the phenomenon of flow reversal which is observed in two-dimensional

simulations of divertor plasmas. The effect is shown to be caused by the radial spread of neutral particles emitted from the divertor target which can lead to a strong peaking of the ionization source at certain radial locations. The results indicate that flow reversal over a portion of the width of the scrape-off layer is inevitable in high recycling conditions. Implications for impurity transport and particle removal in reactors are discussed. DOE

N87-28420# Connecticut Univ., Storrs. Dept. of Physics.
ATOMIC PROCESSES IN HIGH TEMPERATURE PLASMAS Progress Report, 16 Jul. 1985 - 31 Jul. 1987
Y. Hahn 13 Mar. 1987 12 p
(Contract DE-FG02-85ER-53205)
(DE87-010862; DOE/ER-53205/T2) Avail: NTIS HC A02/MF A01

Dielectronic recombination (DR) rates were calculated for the Mg isoelectronic sequence ions, Fe(8+) of the Ar sequence, and the Be sequence. The work on B sequence, Fe(21+), has been initiated. Thus far, we have treated the following isoelectronic sequences; N = 1,2,3,4,10,11,12, and some at N = 18,19, where N is the number of electrons in the ion before capture. External field effect on DR was examined in detail, and the theory is in substantial agreement with experiment in Mg II. The DR-related electron-ion and ion-atom collisions were analyzed, including excitation-autoionization, REDA, and resonant-transfer-excitation. DOE

N87-28421# Technische Hogeschool, Eindhoven (Netherlands).
KINETIC THEORY OF SLIGHTLY NONIDEAL PLASMAS Ph.D. Thesis
Harm Hendrik Brouwer 1987 140 p
(ETN-87-90243) Avail: NTIS HC A07/MF A01

The statistical and the kinetic theory of slightly nonideal plasmas is described. The plasma parameter, a characteristic number for the ratio of interaction energy to kinetic energy, is not very small, though smaller than unity. The equation of motion for the microscopic density functions, the Klimontovich equation, is solved iteratively, with the multiple time scale formalism. As initial condition it is assumed that the correlations between the particles vanish. The average interparticle distance is taken as the characteristic length, which implies the choice of the interaction parameter as perturbation parameter. Landau and Lenard Balescu perturbation schemes are introduced. Electrical conductivity at low and high frequencies is studied. The dispersion relation is discussed. ESA

N87-28422 Max-Planck-Inst. fuer Plasmaphysik, Garching (West Germany).
ROLE OF PLASMA EQUILIBRIUM CURRENT IN ALFVEN WAVE ANTENNA OPTIMIZATION
Satish Puri Dec. 1986 45 p
(IPP-4/230; ETN-87-90320) Avail: Issuing Activity

The modifications in antenna loading produced by plasma equilibrium current, the Faraday shield, and the finite electron temperature for coupling to Alfven waves are studied using a self-consistent, three-dimensional, fully analytic periodic loop antenna model. Results show that the use of high (n = 8) toroidal wave numbers is imperative for obtaining acceptable coupling in the context pertinent to thermonuclear plasma heating. Assuming an antenna configuration of N = 8, a further constraint consists of locating the resonance at two-thirds the plasma radius, which corresponds to depositing the wave energy into the longitudinal motion of the electrons via Landau damping roughly at the center of the plasma volume. Neither of these constraints is significantly altered by the inclusion of the plasma equilibrium current which affects coupling mainly at low n values, which are in any case unsuited for thermonuclear applications. ESA

N87-28423*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GROUND-BASED PLASMA CONTACTOR CHARACTERIZATION
Michael J. Patterson (Washington Univ., Seattle.) and Randall S. Aadland [1987] 17 p Prepared for presentation at the 2nd International Conference on Tethers in Space, Venice, Italy, 6-8 Oct. 1987; sponsored in part by ESA, AIAA and AAS
(NASA-TM-100194; E-3784; NAS 1.15:100194) Avail: NTIS HC A02/MF A01 CSCL 20I

Presented are recent NASA Lewis Research Center (LeRC) plasma contractor experimental results, as well as a description of the plasma contractor test facility. The operation of a 24 cm diameter plasma source with hollow cathode was investigated in the lighted-mode regime of electron current collection from 0.1 to 7.0 A. These results are compared to those obtained with a 12 cm plasma source. Full two-dimensional plasma potential profiles were constructed from emissive probe traces of the contractor plume. The experimentally measured dimensions of the plume sheaths were then compared to those theoretically predicted using a model of a spherical double sheath. Results are consistent for currents up to approximately 1.0 A. For currents above 1.0 A, substantial deviations from theory occur. These deviations are due to sheath asphericity, and possibly volume ionization in the double-sheath region. Author

N87-28424# Sydney Univ. (Australia). Dept. of Plasma Physics.
[EXPERIMENTAL RESEARCH PROGRAM ON THE STUDY OF HYDROMAGNETIC WAVES AND RF HEATING USING THE TORTUS TOKAMAK, AND THE DEVELOPMENT OF DIAGNOSTIC TECHNIQUES] Annual Progress Report
1985 59 p
Avail: NTIS HC A04/MF A01

An experiment was completed which shows quite clearly that antennas used in Alfven wave heating should not have current elements parallel to the steady magnetic field and that they should be operated at frequencies well below omega sub ci, otherwise, the antenna directly excites unwanted Alfven waves in the edge plasma. The scanning submillimeter laser interferometer was used to determine the radial profile of the electron density in TORTUS. The very difficult experimental observation of laser induced fluorescence using the SUPPER II plasma was completed. Thirty-two fast channels were commissioned for the TORTUS data-acquisition system, enabling some rather interesting experiments on magnetic and density fluctuations in TORTUS to be performed with good spatial resolution. B.G.

N87-28425# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Lab. Associados de Plasmas.
REDUCTION OF THE GENERAL SPITZER-HAERM PROBLEM IN PLASMA PHYSICS
Antonio Carlos deAlmeidaFerreira Aug. 1986 15 p Submitted for publication
(INPE-3978-PRE/989) Avail: NTIS HC A02/MF A01

The general Spitzer-Haerm problem is unfolded through a redefinition of the dependent variable into two separate problems. The first takes the form of a second order differential equation, and the second, that of an integration over the solution of the first problem, which provides the distribution function or, directly, the current and the heat flow. It is shown that the current and the heat flow can in general be synthesized from the solutions of the differential equation for two specific forms of the driving term. Author

N87-28426# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A THEORY OF THE COHERENT FUNDAMENTAL PLASMA EMISSION IN TOKAMAKS
Maria V. Alves and Abraham C.-L. Chian Jul. 1987 11 p Presented at the Energy Independence Conference: Fusion Energy and Plasma Physics, Rio de Janeiro, Brazil, 17-21 Aug. 1987
(INPE-4239-PRE/1114) Avail: NTIS HC A02/MF A01

A theoretical model of coherent radiation near the fundamental plasma frequency of Tokamaks is proposed. It is shown that, in the presence of runaway electrons, the beam-generated Langmuir waves (L) can be parametrically converted into electromagnetic waves (T) through ponderomotive coupling to ion acoustic waves (S). Two types of pumps are considered: traveling wave pump and standing wave pump. Expressions are derived for the excitation

conditions and the growth rates of electromagnetic decay instabilities (L yields T + S), electromagnetic fusion instabilities (L + S yields T) and electromagnetic oscillating two-stream instabilities (L yields S +/- S*, where S* is a purely growing mode). Author

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N87-28427# Arizona State Univ., Tempe. Center for Solid State Electronics Research.
THEORETICAL STUDIES OF EXPERIMENTS AND APPLICATIONS OF SUBPICOSECOND PHOTOCONDUCTIVITY Annual Technical Report, 1 Sep. 1985 - 31 Aug. 1986
Robert O. Grondin Apr. 1987 11 p
(Grant AF-AFOSR-0290-84)
(AD-A181669; AFOSR-87-0619TR) Avail: NTIS HC A02/MF A01 CSCL 07E

The reporting period covers the second year of a two year program whose goal is the development and use of models of femtosecond photoconductive experiments as probes of hot carrier transport in semiconductors. The program has been extended for two more years. These experiments are being carried out in a companion effort directed by Dr. Gerald Mourou at the University of Rochester, Rochester, New York. There are several main components to the modeling of such experiments. One must first model the generation of electron-hole pairs inside a semiconductor as the results of the incidence of a femtosecond optical pulse. Then one must model the processes by which the resulting current transient is developed. Lastly, the conversion of the current transient into a voltage wave that is directly measured in the experiments of interest. GRA

N87-28428# Plessey Research (Caswell) Ltd., Towcester (England).
HIGH SPEED TECHNOLOGY DEVELOPMENT AND EVALUATION Final Report
D. R. Parker, E. R. Brown, and J. F. Dickson Paris, France ESA Oct. 1986 98 p
(Contract ESTEC-5005/82-NL-HP(SC))
(CD.6501712; ESA-CR(P)-2380; ETN-87-90165) Copyright Avail: NTIS HC A05/MF A01

Semiconductor technology suited to high on-board data handling rates was investigated. Very high speed discrete logic and high speed gate arrays; single chip digital signal processors and single chip floating point processing peripherals; and analog CCD technologies and custom designed CCD chips for synthetic aperture radar applications were assessed. The 2 micron CMOS technology is highly reliable, supporting semicustom design techniques. Process JGC, the CCD technology, is highly reliable except for tolerance to ionizing radiation. Reliability of the ECL 16-bit serial-parallel parallel-serial converter junction isolated bipolar process, process WZA, is compromised by a design error and oxide contamination contributing to high leakage levels. The bipolar circuit is tolerant to an ionizing radiation of 20kRad. Step stress environmental testing to 200 C produces no failures in CMOS and CCD technologies, but accelerates the degradation of the oxide contaminated bipolar process. All technologies are susceptible to single event upsets. ESA

N87-28429*# Christopher Newport Coll., Newport News, Va. Dept. of Physics.
AN ANLYSIS OF DOPING MODULATED SUPERLATTICE STRUCTURES Final Technical Report, 1 Jun. 1984 - 31 May 1985
A. M. Buoncristiani 31 May 1985 29 p
(Grant NAG1-488)
(NASA-CR-181257; NAS 1.26:181257) Avail: NTIS HC A03/MF A01 CSCL 20L

A new method of growing doping modulated superlattice structures is discussed. This method uses organo-metallic chemical vapor deposition (MO-CVD) with the added feature of controlled plasma in the growth regions. The main objective was to study how the growth environment affected the electronic and optical properties of the superlattice structures. Because a serious safety hazard was discovered in the growth process, no superlattice structures were fabricated and the research on this material had to be terminated. The hazard had to do with the lack of adequate means for the disposal of toxic elemental beryllium. Author

N87-28430*# Virginia State Univ., Petersburg. Solid State Physics Research Inst.
[ACTIVITIES OF THE SOLID STATE PHYSICS RESEARCH INSTITUTE] Annual Report, 1 Jan. - 31 Dec. 1985
31 Dec. 1985 70 p
(Grant NAG1-416)
(NASA-CR-181255; NAS 1.26:181255) Avail: NTIS HC A04/MF A01 CSCL 20L

Topics addressed include: muon spin rotation; annealing problems in gallium arsenides; Hall effect in semiconductors; computerized simulation of radiation damage; single-nucleon removal from Mg-24; and He-3 reaction at 200 and 400 MeV. For individual titles, see N87-28431 through N87-28433.

N87-28431*# Virginia State Univ., Petersburg.
THE HALL EFFECT Annual Report
In its (?)Activities of the Solid State Physics Research Institute 31 Dec. 1985 13 p (For primary document see N87-28430 22-76)
Avail: NTIS HC A04/MF A01 CSCL 20L

The experimental procedure consists of the measurement of the Hall coefficient, resistivity, and Hall mobility as a function of temperature of a sample of gallium arsenides before and after irradiation with low and high energy protons. Work has begun on the development of the theory and subsequently experiments will be designed and performed. B.G.

N87-28432*# College of William and Mary, Williamsburg, Va.
THE 200 MeV Pi+ INDUCED SINGLE-NUCLEON REMOVAL FROM 24Mg **c72**
Donald Joyce, Herbert O. Funsten, B. Joseph Lieb, Hans S. Plendl, Joseph Norton, Carey E. Stronach, V. Gordon Lind, Robert E. McAdams, O. Harry Otteson, and David J. Vieira (Los Alamos National Lab., N. Mex.) et al. *In* Virginia State Univ., (?)Activities of the Solid State Physics Research Institute 31 Dec. 1985 32 p (For primary document see N87-28430 22-76)
Avail: NTIS HC A04/MF A01 CSCL 20H

Nuclear gamma-rays in coincidence with outgoing pions or protons following single nucleon removal from Mg-24 by 200 MeV pions (+) were detected with Ge(Li) detectors. Differential cross sections are reported for gamma-rays from the first excited mirror states of Na-23 and Mg-23 in coincidence with positive pions or protons detected in particle telescopes at 30, 60, 90, 120, and 150 deg; angle-integrated absolute cross sections and cross section ratios are calculated. These results are compared with the predictions of a Pauli-blocked plane-wave impulse approximation (PWIA) and the intranuclear cascade (INC) and nucleon charge exchange (NCX) reaction models. The PWIA and the INC calculations generally agree with the angular dependence of the experimental results but not the absolute magnitude. The NCX calculation does not reproduce the observed cross section charge ratios. Author

N87-28433*# Colorado Univ., Boulder. Nuclear Physics Lab.
THE 4He(p,d)3He REACTION AT 200 AND 400 MeV **c72**
P. W. F. Alons, J. J. Kraushaar, J. R. Shepard, J. M. Cameron, D. A. Hutcheon, R. P. Liljesttand, W. J. McDonald, C. A. Miller, W. C. Olsen, and J. R. Tinsley (Oregon Univ., Eugene.) et al. *In* Virginia State Univ., (?)Activities of the Solid State Physics Research Institute 31 Dec. 1985 9 p (For primary document see N87-28430 22-76)
Avail: NTIS HC A04/MF A01 CSCL 20H

The distorted wave calculations are compared with the He-4(p,d) cross section. At all four energies the theoretical description of the data is relatively poor. While the general magnitude of the cross sections is not in bad agreement, the detailed slopes of the theoretical angular distributions miss the shapes of the experimental data in a rather fundamental way. B.G.

N87-28434# Oak Ridge National Lab., Tenn.
CORRELATIONS AMONG THERMAL PROCESSING, SUPERCONDUCTING PROPERTIES AND MICROSTRUCTURE IN La/SUB 1.85/Sr/SUB 0.15 CuO
D. K. Christen, J. R. Thompson, S. T. Sekula, L. A. Boatner, B. C. Sales, and S. J. Pennycook May 1987 3 p Presented at the 18th Conference on Low Temperature Physics, Kyoto, Japan, 20 Aug. 1987
(Contract DE-AC05-84OR-21400)
(DE87-009825; CONF-870873-3) Avail: NTIS HC A02

For various thermal processing conditions, measurements of the electrical transport and superconducting magnetic properties have been correlated with the microstructure as determined by X-ray diffraction and transmission electron microscopy. We find the largest critical current densities J sub c are associated with the presence of coherent second-phase precipitates, and are significantly higher than for materials containing only grain boundaries or dislocations as flux pinning sites. Low-temperature annealing in oxygen results in nearly perfect, defect-free grains, separated by clean, planar grain boundaries. We conclude that the temperature-dependent diamagnetic response below T sub c cannot be explained by the observed gross microstructure. DOE

N87-28435# California Univ., Berkeley. Lawrence Berkeley Lab.
GENERAL DESCRIPTION OF A SEMICONDUCTOR SUPERLATTICE
K. Krushwitz Apr. 1987 22 p
(Contract DE-AC03-76SF-00098)
(DE87-011214; LBL-23488) Avail: NTIS HC A02/MF A01

A qualitative description of the physics of a semiconductor superlattice is presented in relation to chemistry. A section of this paper is devoted to semiconductor superlattice construction to underscore the salient characteristics of electrical conductivity, photoluminescence and optical enhancement for elements in Groups III-VI of the periodic table. DOE

N87-28436# Chicago Univ., Ill.
THEORETICAL HIGH ENERGY PHYSICS RESEARCH AT THE UNIVERSITY OF CHICAGO
Jonathan L. Rosner 1987 15 p
(Contract DE-AC02-82ER-40073)
(DE87-011217; DOE/ER-40073/T2) Avail: NTIS HC A02/MF A01

Research activities reported include: exotic fermions and gauge bosons in superstring models, collider physics, heavy quark spectroscopy, CP violation, color sextet quarks, neutral heavy leptons, fermion masses and supersymmetry, magnetic moments of baryons and other constraints on configuration mixing, dynamical mass generation, N = 2 supersymmetric QCD, and matrix methods in quantum mechanics. Other work addresses a fixed-target program and other non-SSC initiatives, hadroproduction of heavy quarks, electroproduction phenomenology at very small values of x, and spectrometer designs for the SSC. The novel physics possibilities of hadron colliders have been considered, and work is reported on radiative decays of the J/psi and on D-wave quarkonium levels, on the connection of elementary particles with cosmology and astrophysics, and conformal field theory. A rigorous development of the theory of super Riemann surfaces was developed with a view toward superstring applications. Work was pursued on supersymmetry breaking in the observable sector of superstring models and on inflationary cosmology. DOE

N87-28437# Technische Hogeschool, Delft (Netherlands). Dept. of Metals Science and Technology.
HELIUM TRAPPING IN COLD WORKED SINGLE CRYSTALLINE MOLYBDENUM OBSERVED WITH THERMAL HELIUM DESORPTION SPECTROMETRY Ph.D. Thesis
Wilhelmus Theodorus Buters 1987 143 p Sponsored by the Netherlands Organization for the Advancement of Pure Research
(ETN-87-90238) Avail: NTIS HC A07/MF A01

Immediately after cold working and subsequent helium ion implantation (150 eV) in molybdenum, desorption of helium from vacancies and vacancy clusters is seen in the spectra. No helium desorption from dislocations is recognized. Upon annealing beyond stage III (500K), i.e., the annealing out of monovacancies, the monovacancy part in the desorption spectra decreases rapidly. The vacancy cluster part gradually disappears in the temperature interval 900 to 1500K. Monte Carlo simulations indicate that a dislocation density of 5 billion sqcm represents the same trapping strength as a point defect concentration of 1 appm. Since transmission electron microscopy observations reveal the existence of a uniform dislocation density in the deformed specimens of 5 billion sqcm, any trapping of helium at dislocations should be observed. Retrapping effects probably suppress the visible desorption of helium from dislocations, but cannot explain a total absence of dislocation related desorption peaks. ESA

N87-28438# Technische Hogeschool, Delft (Netherlands).
THE DISLOCATION STRUCTURE OF TWIST BOUNDARIES AND THE INFLUENCE OF IMPURITIES Ph.D. Thesis
Johan Hamelink 1987 179 p
(ETN-87-90239) Avail: NTIS HC A09/MF A01

Properties of grain boundaries were studied to assess the relaxation between the structure of interfaces and the orientation difference of the two crystals surrounding the interface. The influence of impurities on grain boundary structure was evaluated on UHV-prepared bicrystals containing a few atomic layers of a known impurity element in the interface region, using Co, Mn, and Cr. Dislocation networks occur at 500 C, higher than the 250 C required for relaxation in clean grain boundaries. The relaxation process starts when the impurity layer thickness decreases to one atomic layer by diffusion of the impurity out of the interface. Another difference compared to clean grain boundaries, when cobalt or chromium were used as an impurity is the irregular dislocation networks at the beginning of the relaxation process, which become more regular during further annealing. Migration of a low-angle boundary, a near-coherent twin boundary, and a Sigma = 57 high-angle boundary are observed. Not all migration phenomena can be explained from the reduction of grain boundary area. ESA

N87-28439# Ames Lab., Iowa.
SUPERCONDUCTIVITY, MAGNETISM, AND CHARGE DENSITY WAVE FORMATION IN TERNARY COMPOUNDS WITH THE Sc5Co4Si10-TYPE STRUCTURE
Hung-Duen Yang Jun. 1987 118 p
(Contract W-7405-eng-82)
(DE87-010927; IS-T-1281) Avail: NTIS HC A06/MF A01

The variation of the superconducting transition temperature T(sub c) with hydrostatic pressure up to 23.7 kbar is reported for eleven compounds with the Sc5Co4Si10-type structure. Most of these compounds display a modest linear depression of T(sub c) with pressure (dT(sub c)/dp approx. 10 to the -5 K/bar); however, two materials, Lu5Ir4Si10 and Lu5Rh4Si10, undergo a discontinuous transformation above a critical pressure of about 20 kbar to a state with a significantly higher T(sub c). The resistivity and magnetic susceptibility show an anomaly in Lu5Ir4Si10 and Lu5Rh4Si10 at T sub 0 = 83 K and 155 K, respectively. It is interpreted that this phase transformation may involve a charge density wave (CDW) formation that opens an energy gap over a portion of the Fermi surface. The P-T phase diagram for Lu5Ir4Si10, given to demonstrate the correlation between T sub 0 and T(sub c), provides the clear evidence that the pressure enhancement of T(sub c) is due to progressive removal of the charge density wave in crystal. DOE

N87-28440# Harry Diamond Labs., Adelphi, Md.
AVALANCHING IN SINGLE-EVENT-UPSET CHARGE COLLECTION IN SEMICONDUCTOR DIODES Final Report, Oct. 1985 - Jun. 1986
Alford L. Ward Feb. 1987 24 p
(Contract DA Proj. 1L1-62120-AH-25)
(AD-A181452; HDL-TR-2106) Avail: NTIS HC A02/MF A01 CSCL 20L

The one-dimensional computer program DIODE has been used to calculate charge collection in single ionizing events in silicon and gallium arsenide diodes. Avalanche multiplication is calculated to occur above a threshold of 3 V in a silicon diode, in agreement with published measurements. Since avalanching may lead to burnout in very large integration semiconductors, it is a greater danger than the funneling effect of space charge. Carrier recombination is found to be important in gallium arsenide. GRA

N87-28441*# Hughes Aircraft Co., Goleta, Calif. Research Center.
DEVELOPMENT OF A P-I-N HgCdTe PHOTOMIXER FOR LASER HETERODYNE SPECTROMETRY Final Report
Peter R. Bratt Sep. 1987 61 p
(Contract NAS1-16057)
(NASA-CR-4094; NAS 1.15:4094; Rept-62562) Avail: NTIS HC A04/MF A01 CSCL 20L

An improved HgCdTe photomixer technology was demonstrated employing a p-i-n photodiode structure. The i-region was near intrinsic n-type HgCdTe; the n-region was formed by B+ ion implantation; and the p-region was formed either by a shallow Au diffusion or by a Pt Schottky barrier. Experimental devices in a back-side illuminated mesa diode configuration were fabricated, tested, and delivered. The best photomixer was packaged in a 24-hour LN2 dewar along with a cooled GaAs FET preamplifier. Testing was performed by mixing black-body radiation with a CO2 laser beam and measuring the IF signal, noise, and signal-to-noise ratio in the GHz frequency range. Signal bandwidth for this photomixer was 1.3 GHz. The heterodyne NEP was 4.4 x 10 to the -20 W/Hz out to 1 GHz increasing to 8.6 x 10 to the -10 W/Hz at 2 GHz. Other photomixers delivered on this program had heterodyne NEPs at 1 GHz ranging from 8 x 10 to the -20 to 4.4 x 10 to the -19 W/Hz and NEP bandwidths from 2 to 4 GHz. Author

N87-28442# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Laboratorio Associado de Sensores e Materiais.
IMPURITY BANDS IN Ga (1-x)Al (x)As/GaAs QUANTUM WELLS
E. A. deAndradaeSilva and I. C. daCunhaLima Mar. 1987 14 p Submitted for publication
(INPE-4138-PRE/1046) Avail: NTIS HC A02/MF A01

The Density-of-States (DOS) for electrons bound to impurities in a thin sheet inside a Ga(1-x)Al(x)As/GaAs quantum well is calculated. Impurities are considered at the center, midway to the interface and at the interface of the GaAs layer. It is shown that for reasonable impurity concentrations an impurity band appears separated from the lowest subband. The bandwidth is comparable with that obtained due to diagonal disorder assuming a uniform distribution inside the whole well. Author

N87-28443# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
EXPERIMENTAL STUDY OF ELECTRONIC STATES AT INTERFACES Final Report, 1 Jun. 1985 - 31 Aug. 1986
A. J. Sievers 1987 66 p
(Grant AF-AFOSR-0175-85)
(AD-A181928; AFOSR-87-0851TR) Avail: NTIS HC A04/MF A01 CSCL 20L

The goal of this research program has been to explore and understand the interaction of electromagnetic radiation with the low lying excitation spectra in condensed matter and on clean metal surfaces. Coherent optical, infrared, and far infrared techniques have been required to probe the dynamics of these many body systems both in and out of thermal equilibrium. The formation of persistent spectral holes is one new aspect of solid state spectroscopy. Another is the discovery of large far infrared nonlinearities in high mobility two dimensional electron gas semiconducting systems. GRA

N87-28444# Utah Univ., Salt Lake City. Dept. of Physics.
VOLTAGE FLUCTUATIONS AT SODIUM BETA' ALUMINA/MERCURY ELECTRODES Technical Report, Jan. - Jun. 1987
Chu K. Kuo and James J. Brophy Jun. 1987 15 p
(Contract N00014-82-K-0603)
(AD-A182102; AD-E951005; TR-13-ONR) Avail: NTIS HC A02/MF A01 CSCL 09A

Voltage fluctuations at mercury sodium Beta alumina ceramic electrode interfaces have been investigated. Noise voltages in the absence of current can be explained by Nyquist and interfacial chemical reaction noise. The activation energy of the reaction noise rate constant is determined to be 0.29 eV, which suggests that diffusion of the sodium ions in the electrolyte dominates the reaction. In the presence of a decomposition current, the low frequency noise varies. After current flow, the noise voltage decays and can be observed for some tens of hours. Both current and post current noise signals suggest conductivity fluctuations arising from diffusion of the mobile sodium ions. Fitting experimental data to the diffusion and decay equations yields a diffusion constant of .000008 sq cm per second and a characteristic length equal to the bulk sample length. GRA

N87-28445# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
SOLID STATE RESEARCH Quarterly Technical Report, 1 Aug. - 31 Oct. 1986
Alan L. McWhorter 15 Nov. 1986 90 p
(Contract F19628-85-C-0002)
(AD-A182215; Rept-1986:4; ESD-TR-86-135) Avail: NTIS HC A05/MF A01 CSCL 09A

The topics covered in this Solid State status report are Solid State Device Research, Quantum Electronics, Materials Research, Microelectronics, and Analog Device Technology. GRA

N87-28446# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
DIFFUSION AND DEFECT CHARACTERIZATION STUDIES OF MERCURY CADMIUM TELLURIDE Semiannual Progress Report, 1 Aug. 1986 - 31 Jan. 1987
David A. Stevenson 1 Jun. 1987 5 p
(Contracts N00014-84-K-0423; ARPA Order 5019)
(AD-A182237) Avail: NTIS HC A02/MF A01 CSCL 07B

The report describes progress on diffusion studies in Mercury Cadmium Telluride and on growth studies in Mercury Cadmium Telluride. The former emphasizes self-diffusion isoconcentration or tracer diffusion measurements, interdiffusion measurements, and the analysis of the relationship between the self-diffusion coefficients and the interdiffusion coefficients for pseudo-binary systems. The growth studies concern the characterization of isothermal vapor phase epitaxial MCT layers (ISOVPE) using defect etching and Rutherford backscattering methods (RBS). GRA

N87-28447# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
A CHEMICAL AND THEORETICAL WAY TO LOOK AT BONDING ON SURFACES
Roald Hoffmann Jul. 1987 64 p
(Contract N00014-82-K-0576)
(AD-A182547; TR-31) Avail: NTIS HC A04/MF A01 CSCL 07D

An account is given of a theoretical approach to surface structure and reactivity that is within the framework of solid state theory, yet strives for chemical ways of interpretation. One begins then from highly delocalized band structures, but introduces interpretational tools (density of states decompositions, crystal orbital overlap populations) that allow a tracing of local, chemical acts. It is quite feasible to construct interaction diagrams for

surfaces, and to make frontier orbital arguments, just as for molecules. There are some interesting ways in which the surface-adsorbate interaction differs from simple molecular binding - in particular, in the way that two-orbital four- and zero-electron interactions can turn into bonding. The surface and bulk acting as a reservoir of electrons or holes at the Fermi level are important in this context. Chemisorption emerges as a compromise in a continuum of bonding whose extremes are dissociative adsorption and surface reconstruction. GRA

N87-28448# Naval Academy, Annapolis, Md.
NUCLEAR MAGNETIC RESONANCE IN GALLIUM ARSENIDE Final Report, 1986 - 1987
Michael F. Finch 19 May 1987 44 p
(AD-A182666; USNA-TSPR-144) Avail: NTIS HC A03/MF A01 CSCL 09A

Nuclear Magnetic Resonance (NMR) lineshapes of Ga-69 in GaAs:In were studied for two different levels of indium dopant. The lineshapes were developed by Fourier analysis of the spin echoes. First order quadrupole effects manifested themselves as wings in the lineshapes. As expected the wings were larger in the more heavily doped sample. The dependence of the second moment of the lineshapes on the orientation of the crystal in the field supports a continuous solid model of the strain, in which the strain attenuates as the cube of the distance from the impurity site. Because of noise levels the model can only be confirmed for distances greater than 10A from the impurity, and no determination of the strain on the first through eighth shells surrounding the impurity can be made. GRA

N87-28449# Cornell Univ., Ithaca, N.Y.
SILICIDE/Si INTERFACES IN VLSI STRUCTURES Final Technical Report, 1 May 1984 - 30 Sep. 1986
James W. Mayer 15 Jun. 1987 17 p
(Contract N00014-84-K-0342)
(AD-A182718) Avail: NTIS HC A02/MF A01 CSCL 09A

The objective of this program was to investigate Silicide Si interfaces using electron energy loss spectroscopy, electron micro-diffraction and electron induced x ray emission with fine-focussed electron beams. For silicide studies we used self-supporting lateral diffusion couples because thin samples are needed to minimize electron-beam and maximize spatial resolution. In nickel silicide structures, high resolution measurements were made of composition, structure and interface width; the compositional width of the nickel silicide interface boundary is at most 10 nonometers. The successful application of these techniques allowed us to investigate other technologically important interfaces: amorphous alloys, poly silicon silicon and gallium/arsenide gallium/indium/arsenide interfaces. In the latter case, electron energy loss measurements using a scanning transmission electron microscope allowed identification of electronic states associated with a single misfit dislocation. GRA

N87-28450# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Lab. Associado de Sensores e Materiais.
DOMAIN-WALL INDUCED XY DISORDER IN THE FULLY FRUSTRATED XY MODEL
Enzo Granato Feb. 1987 12 p Submitted for publication
(INPE-4126-PRE/1041) Avail: NTIS HC A02/MF A01

The defect-mediated phase transition in the fully frustrated XY model is discussed. A Migdal-Kadanoff position-space renormalization group analysis is employed to investigate the critical behavior of a similar model in the same universality class as the fully frustrated XY model. The resulting phase diagram shows that XY order cannot co-exist with Ising disorder. This is in agreement with recently suggested phase-transition scenario in the fully frustrated XY model. Author

N87-28389# Joint Publications Research Service, Arlington, Va.
NUCLEAR MAGNETIC RESONANCE IN HEAVY-FERMION SUPERCONDUCTOR UBeSUB13 Abstract Only
N. Ye. Alekseyevskiy and Ye. G. Nikolayev *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 49-50 Transl. into ENGLISH from Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 91, no. 5(11), Nov. 1986 p 1820-1831 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

N87-28390# Joint Publications Research Service, Arlington, Va.
PROPERTIES OF ANISOTROPIC DISORDERED SUPERCONDUCTOR SYSTEM IN NORMAL METAL Abstract Only
L. G. Aslamazov, A. A. Dyachkov, and S. V. Lempitskiy *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 50 Transl. into ENGLISH from Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 91, no. 5(11), Nov. 1986 p 1776-1788 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

N87-28391# Joint Publications Research Service, Arlington, Va.
LECTURE DEMONSTRATIONS OF PROPERTIES OF SUPERCONDUCTORS AND LIQUID HELIUM Abstract Only
Ye. M. Gershenzon, G. N. Goltsman, A. I. Yelantyev, Ye. B. Petrova, N. G. Ptitsina, and V. S. Filatov *In its* USSR Report: Physics and Mathematics 17 Jun. 1987 p 51 Transl. into ENGLISH from Fizika (Tomsk, USSR), v. 24, no. 7, Jul. 1986 p 110-112 (For primary document see N87-28378 22-70)
Avail: NTIS HC A05/MF A01

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N87-28451*# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
SIMPLIFIED CURVE FITS FOR THE THERMODYNAMIC PROPERTIES OF EQUILIBRIUM AIR
S. Srinivasan, J. C. Tannehill, and K. J. Weilmuenster Jun. 1986 100 p
(Grant NAG1-313)
(NASA-CR-181245; NAS 1.26:181245; ISU-ERI-Ames-86401; CFD-15) Avail: NTIS HC A05/MF A01 CSCL 20M

New improved curve fits for the thermodynamic properties of equilibrium air were developed. The curve fits are for p = p(e,rho), a = a(e,rho), T = T(e,rho), s = s(e,rho), T = T(p,rho), h = h(p,rho), rho = rho(p,s), e = e(p,s) and a = a(p,s). These curve fits can be readily incorporated into new or existing Computational Fluid Dynamics (CFD) codes if real-gas effects are desired. The curve fits were constructed using Grabau-type transition functions to model the thermodynamic surfaces in a piecewise manner. The accuracies and continuity of these curve fits are substantially improved over those of previous curve fits appearing in NASA CR-2470. These improvements were due to the incorporation of a small number of additional terms in the approximating polynomials and careful choices of the transition functions. The ranges of validity of the new curve fits are temperatures up to 25,000 K and densities from 10 to the minus 7th to 100 amagats (rho/rho sub 0). Author

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N87-28452*# Systematics General Corp., Sterling, Va.
THE DEVELOPMENT OF PERFORMANCE, INTERFERENCE, SHARING AND COORDINATION CRITERIA
Tom Tillotson Jul. 1986 40 p
(Contract NASw-3973)
(NASA-CR-180365; NAS 1.26:180365) Avail: NTIS HC A03/MF A01 CSCL 05A

The criteria for sharing and coordination between the Earth Exploration Satellite service and other radio services is not fully developed at this time. The purpose is to develop a plan showing how the necessary criteria might be developed. Some criteria does exist in the form of general restrictions, protection criteria, and coordination procedures for space and terrestrial services sharing the same bands. Determining suitable criteria for EES bands depends on the use of the band and the shared services. For example the criteria developed for EES passive sensing band will be developed in a manner different than for a telemetry band. In either case the resultant criteria will be related to, and can be referenced from the system noise power or equivalent noise temperature. B.G.

N87-28453# Rome Air Development Center, Griffiss AFB, N.Y.
ROME AIR DEVELOPMENT CENTER AIR FORCE TECHNICAL OBJECTIVE DOCUMENT FY88
Carlo P. Crocetti Dec. 1986 67 p
(AD-A182001; RADC-TR-86-245; RADC-TOD-86-11) Avail: NTIS HC A04/MF A01 CSCL 05A

This TOD describes the technical programs of the Rome Air Development Center in support of the Air Force Command, Control, Communications, and Intelligence (C3I) mission. The technical objectives have been aligned with the VANGUARD mission areas of Command Control and Communications (C3), Reconnaissance and Intelligence, Strategic Systems (Defense) and Technology as a means of focusing the RADC support of VANGUARD. This document is prepared to provide industry and universities with the midterm technical objectives in these areas. GRA

N87-28454# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
AIR FORCE TECHNICAL OBJECTIVE DOCUMENT, FY88
1 Nov. 1986 83 p Supersedes AFWAL-TR-83-1000, AD-C033513
(AD-A182205; AFWAL-TR-86-1000; AFWAL-TR-83-1000) Avail: NTIS HC A05/MF A01 CSCL 05A

This TOD describes the technology required to meet future avionics operational needs. The Avionics Lab investment strategy is described. The technology program is described in terms of four Technical Areas which correspond to the groupings of the eight Laboratory Technology Planning Objectives (TPOs). The technology approaches are discussed together with related applications to Air Force needs and requirements. Information from the FY87 Technical Program Plans is included. Points of contact in the Laboratory are identified for each Laboratory TPO. If areas of interest are discovered, industry or academic organizations are encouraged to discuss the objectives further with the Laboratory contact identified to maximize contributions to military technology. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.

For computer documentation see *61 Computer Programming and Software.*

N87-28455*# National Aeronautics and Space Administration, Washington, D.C.
NASA EDUCATIONAL PUBLICATIONS
[1987] 24 p
(PAM-101/7-87; SB-222) Avail: SOD HC free as
021-222-00702-4 (Subject Bibliography 222) CSCL 05B

This is a catalog of educational and technical publications, sponsored by NASA, that are available to the general public from the Government Printing Office (GPO). The following types of publications are announced: periodicals, educational publications, NASA Facts, posters and wallsheets, other publications of interest to educators, scientific and technical publications, and educational materials from Regional Service Centers. J.P.B.

N87-28456# Logica Ltd., London (England).
PILOT NETWORK DESIGN STUDY, SUMMARY
M. A. Price, A. Thompson, D. Nolan, and P. S. Hansell Paris, France ESA 4 Jul. 1986 29 p
(Contract ESA-6291/85-HGE-I)
(Rept-74.5517-Vol-1; ESA-CR(P)-2352-Vol-1; ETN-87-99998)
Copyright Avail: NTIS HC A03/MF A01

Ways in which a European space science data archival, retrieval, and dissemination system can best fulfil user requirements were assessed. Data characteristics of missions to be archived; user requirements for a central data archive and communication system; conceptual architecture design of the system; existing communication facilities; the functional breakdown and specification of a pilot system; a detailed requisite hardware, software, and communication link definition; and cost of implementation and recurrent expenses are discussed. ESA

N87-28457# Logica Ltd., London (England).
PILOT NETWORK DESIGN STUDY Final Report
M. A. Price, A. Thompson, D. Nolan, and P. S. Hansell Paris, France ESA 4 Jul. 1986 226 p
(Contract ESA-6291/85-HGE-1)
(Rept-74.5517-Vol-2; ESA-CR(P)-2352-Vol-2; ETN-87-99999)
Copyright Avail: NTIS HC A11/MF A01

Ways in which a European space science data archival, retrieval, and dissemination system can best fulfil user requirements were assessed. Data characteristics of missions to be archived; user requirements for a central data archive and communication system; conceptual architecture design of the system; existing communication facilities; the functional breakdown and specification of a pilot system; a detailed requisite hardware, software, and communication link definition; and cost of implementation and recurrent expenses are discussed. ESA

N87-28458# Environmental Protection Agency, Washington, D.C. Information Management and Services Div.
BIBLIOGRAPHY ON INFORMATION RESOURCES MANAGEMENT
Nov. 1985 45 p
(PB87-185997; EPA/IMSD-85/003) Avail: NTIS CSCL 05B

The bibliography documents the controversy over the definition of information resources management (IRM) from office automation systems and management information systems to the current user oriented state of the art. It includes citations from 1980, when the Paperwork Reduction Act was passed, to the present. A survey of expert opinion of future developments of IRM is included, as are case studies of IRM as implemented in various organizations. Author

N87-28459# Central Intelligence Agency, Washington, D.C.
WORLD DATA BANK 2 (WDB2). GENERAL USERS GUIDE
A. J. Gorny and R. Carter Jan. 1987 10 p 5 magnetic tapes are included as supplements
(PB87-184818; PB87-184768; CIA/DF/MT-87/002A) Avail: NTIS HC A02/MF A01; 5 magnetic tapes are available as PB87-184768 CP T06 CSCL 05B

World Data Bank 2 is a digital representation of the world divided into four geographic areas: North America, South America, Europe/Africa, and Asia. The data file is contained on magnetic tapes. The General Users Guide describes the physical format of the data and defines the breakdown of data within each of the separate files into features and subordinate classifications/ranks. Author

N87-28460# Sandia National Labs., Albuquerque, N. Mex.
INFORMATION NETWORK FOR NUMERIC DATABASES OF MATERIALS PROPERTIES
F. C. Allan Jun. 1987 14 p Presented at the 78th Annual Conference of the Special Libraries Association, Anaheim, Calif., 6 Jun. 1987
(Contract DE-AC04-76DP-00789)
(DE87-010512; SAND-87-0215C; CONF-8706131-1) Avail: NTIS HC A02

This talk traces the development of a network system for materials properties. It shows what our library has done to be involved. But we have benefitted also. First, there is the sense of being involved in a vital and active process, which has possibilities of developing in various ways. Then there is the feeling that we are contributing to that which we will also be using in the future. In addition, involvement has made us aware of what else has been going on world-wide and the increasing cooperation evolving among all participants. Last, there is the satisfaction from the idea that we are contributing uniquely from our status as a special library. DOE

N87-28461# Lawrence Livermore National Lab., Calif.
HIGH RESOLUTION DATA BASE FOR USE WITH MAP
W. C. Tapley and D. B. Harris May 1987 29 p
(Contract W-7405-eng-48)
(DE87-011601; UCID-21084) Avail: NTIS HC A03/MF A01

A high resolution cartographic data base of the World is available from the CIA. This data was obtained, portions extracted, and cartographic files of varying resolutions produced. The resulting data files are of the proper format for use with MAP, the in-house cartographic plotting program. DOE

N87-28462# RJO Enterprises, Inc., Lanham, Md.
MAJOR AUTOMATED INFORMATION SYSTEM REVIEW COUNCIL (MAISRC) GUIDELINES FOR PROGRAM MANAGERS Final Report
Jun. 1987 102 p
(Contract MDA903-85-C-0368)
(AD-A181987) Avail: NTIS HC A06/MF A01 CSCL 05B

The Major Automated Information System Review Council (MAISRC) serves at the Department of Defense (DOD) senior management decision-making body for Automated Information Systems (AIS). This process needs to be understood by AIS Program Managers and component staffs in order for the MAISRC to complement our Life Cycle Management (LCM) policies set forth in Department of Defense Directive (DODD) 7920.1 and Department of Defense Instruction (DODI) 7920.2. Therefore, the Office of the Secretary of Defense (OSD) staff has prepared these MAISRC Guidelines for Program Managers' use and understanding. The Guidelines explain the who, what, when, where, and why of the MAISRC process. The information presented should assist a Program Manager in better understanding and preparing for a MAISRC review. It is recognized that program management and development is not a precise science and tailoring must occur. Therefore, the MAISRC management process has provisions to adapt these Guidelines to the specific nature of the program under review. GRA

N87-28463*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PUBLICATIONS OF THE JET PROPULSION LABORATORY, 1986
15 Aug. 1987 34 p
(NASA-CR-181328; NAS 1.26:181328; JPL-Bibl-39-28) Avail: NTIS HC A03/MF A01 CSCL 05B

JPL Bibliography 39-28 describes and indexes by primary author the externally distributed technical reporting, released during calender year 1986, that resulted from scientific and engineering work performed, or managed, by the Jet Propulsion Laboratory. Three classes of publications are included: (1) JPL Publications in which the information is complete for a specific accomplishment, (2) Articles from the quarterly Telecommunications and Data Acquisition (TDA) Progress Report, and (3) Articles published in the open literature. Author

N87-28464# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ACQUISITION OF DATA TREATMENT FOR A GEOGRAPHICAL INFORMATION SYSTEM M.S. Thesis - Feb. 1986 [AQUISICAO DE TRATAMENTO DE DADOS PARA UM SISTEMA GEOGRAFICO DE INFORMACOES]
Misae Odo BuenodeOliveira May 1987 75 p In PORTUGUESE; ENGLISH summary
(INPE-4172-TDL/272) Avail: NTIS HC A04/MF A01

A method for digitalization and treatment of thematic maps to be integrated in a greater system, the Geographical Information System (SGI) is presented. The present system is being developed in standard equipment, and using computer graphics tools. The different system phases are presented, as well as the description of the algorithm used in these phases. Author

N87-28465# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
INSERTION, REMOVAL, AND ALTERATION OF DATA IN A RELATIONAL DATA BASE: AN APPLICATION IN THE RELATIONAL PROJECT OF INPE/DSC/DIN M.S. Thesis - Apr. 1986 [INSERCAO, REMOCAO E ALTERACAO DE DADOS EM BANCO DE DADOS RELACIONAIS: UMA APLICACAO AO PROJETO RELACIONAL DO INPE/DSC/DIN]
Andre VilacadosSantos Mar. 1987 67 p In PORTUGUESE; ENGLISH summary
(INPE-4137-TDL/266) Avail: NTIS HC A04/MF A01

An interface for data base update to the relational system developed by INPE for systems Burroughs B6000/B7000 is described. Author

N87-28466 Louisiana State Univ., Baton Rouge.
THE TOPOLOGICAL INFORMATION RETRIEVAL SYSTEM AND THE TOPOLOGICAL PARADIGM: A UNIFICATION OF THE MAJOR MODELS OF INFORMATION RETRIEVAL Ph.D. Thesis
Steven C. Cater 1986 93 p
Avail: Univ. Microfilms Order No. DA8710552

Three topics are discussed in this work. The first topic is an investigation of the topological properties of the p-norm model of Salton, Fox, and Wu. It is shown that certain properties of the p-norm model that one would expect to hold, given the topological origin of the model, do not in fact hold. These properties include the ability to change the query by changing p, and the ability to adequately separate documents. Since these properties do not hold in the model as actually constructed, it must be that the properties do not follow from the topological origin of the model. The second topic is a search for a usable model with an adequate theoretical basis. In order to construct such a model, the topological paradigm is defined. This paradigm establishes a minimal set of requirements that any system with a topological foundation should have. A particular example of the paradigm, the Topological Information Retrieval System (TIRS), is constructed. A discussion of the various query systems that may be used with TIRS is given. The third topic is a reexamination of the standard models of information retrieval, considered as cases of the topological paradigm. The paradigm is shown to be a unifying model, in that

all of the standard models, i.e., the boolean, vector space, fuzzy set theoretic, and probabilistic and hierarchical models, are shown to be instances of the paradigm. Dissert. Abstr.

N87-28467 George Washington Univ., Washington, D.C.
AUTOMATIC TRANSLATION OF QUERY LANGUAGE IN HETEROGENEOUS DATABASE MANAGEMENT SYSTEMS Ph.D. Thesis
Michael Charles Frame 1987 183 p
Avail: Univ. Microfilms Order No. DA8711440

A heterogeneous database management system (HDBMS) is a set of dissimilar, but cooperating local database management systems (LDBMSs). The LDBMSs may reside on separate computer systems. The HDBMS provides uniform access to the data in all of these databases available to users of all of the computer systems. Users have the impression of interfacing with a single database. One of the problems that exists in providing such a capability is interacting with the various query languages that the LDBMSs provide. The design of an HDBMS is presentd that includes a table driven translator based upon attribute grammars. Attribute grammars define the syntax and the semantics of a language. A new LDBMS may be added simply by defining an attribute grammar for its query language. The HDBMS includes algorithms for: translating the common query language to an internal form; decomposing the internal forms based upon the participating LDBMSs; and translating the decomposed parts each to the appropriate query language. Author

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

N87-28468# King Research, Inc., Rockville, Md.
COST-BENEFIT ANALYSIS OF US COPYRIGHT FORMALITIES Final Report, 1984-1985
D. W. King, R. R. V. Wiederkehr, and M. K. Yates Feb. 1987 168 p Sponsored by Library of Congress, Washington, D.C.
(PB87-183620) Avail: NTIS HC A08/MF A01 CSCL 05D

The costs and benefits of the U.S. system of copyright formalities were investigated. The copyright formalities of interest are copyright notice, deposit, registration, and recordation. Notice refers to the requirement that a published work contains a copyright notice. Deposit is the requirement that one or more copies of the work be deposited with the Library of Congress. Registration itself is the procedure in which the basic facts of ownership (copyright) are placed on public record. Finally, recordation is the process whereby a public record is maintained by the Copyfight Office of transfers or changes in ownership rights. A conceptual framework was developed to address the volume, costs and benefits of activities related to the four formalities. Thus at the conclusion of the study there would be a basis for comparing all the formalities costs bases on transaction quantities or volume, and their effectiveness in terms of the consequences of them. A second objective of the study was to compare the U.S. system of formalities with those of formality-like systems in England, Sweden, and France. GRA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see also *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N87-28469# Royal Norwegian Council for Scientific and Industrial Research, Tromso. Telemetry Station.
EUROPEAN UTILIZATION OF TIROS-N DATA. PROPOSAL FOR A COORDINATED SERVICE Final Report
E. Ellingsen, M. R. Boswell, O. Hogtun, J. P. Pederson, and C. McGeachy (Software Sciences Ltd., Farnborough, England) Paris, France ESA Aug. 1986 220 p
(Contract ESA-6296/86-HGE-1)
(ESA-CR(P)-2336; ETN-87-99985) Avail: NTIS HC A10/MF A01

Increasing use of AVHRR data for nonmeteorological purposes prompted a survey of present and future receiving stations that supply AVHRR data for Europe and a survey of user requirements. Scenarios to show how a coordinated service within Europe could be achieved are presented. The survey shows that within the user community the swing to use the AVHRR sensor can be attributed to the availability of the data. This is due to the wide swath width achieving a high repetition cycle and the relatively low cost compared to other forms of remotely sensed data. The scenarios show that the number of stations could be reduced dramatically, especially if planned stations become operational. A central facility for scheduling and cataloguing would simplify the management fo the European service. A central data archive acting as a single point of contact would greatly reduce problems faced by users. ESA

N87-28470*# Cummins Engine Co., Inc., Columbus, Ind.
TECHNICAL AND ECONOMIC STUDY OF STIRLING AND RANKINE CYCLE BOTTOMING SYSTEMS FOR HEAVY TRUCK DIESEL ENGINES Final Report
I. Kubo Sep. 1987 171 p
(Contracts DEN3-361; DE-AI01-86CE-50162)
(NASA-CR-180833; DOE/NASA-0361-1; NAS 1.26:180833; CTR-0723-87001) Avail: NTIS HC A08/MF A01 CSCL 13F

Bottoming cycle concepts for heavy duty transport engine applications were studied. In particular, the following tasks were performed: (1) conceptual design and cost data development for Stirling systems; (2) life-cycle cost evaluation of three bottoming systems - organic Rankine, steam Rankine, and Stirling cycles; and (3) assessment of future directions in waste heat utilization research. Variables considered for the second task were initial capital investments, fuel savings, depreciation tax benefits, salvage values, and service/maintenance costs. The study shows that none of the three bottoming systems studied are even marginally attractive. Manufacturing costs have to be reduced by at least 65%. As a new approach, an integrated Rankine/Diesel system was proposed. It utilizes one of the diesel cylinders as an expander and capitalizes on the in-cylinder heat energy. The concept eliminates the need for the power transmission device and a sophisticated control system, and reduces the size of the exhaust evaporator. Results of an economic evaluation indicate that the system has the potential to become an attractive package for end users. Author

88 SPACE SCIENCES (GENERAL)

N87-28471*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CALCULATION AND ACCURACY OF ERBE SCANNER MEASUREMENT LOCATIONS

Lawrence H. Hoffman, William L. Weaver, and James F. Kibler Sep. 1987 34 p
(NASA-TP-2670; L-16218; NAS 1.60:2670) Avail: NTIS HC A03/MF A01 CSCL 03B

The Earth Radiation Budget Experiment (ERBE) uses scanning radiometers to measure shortwave and longwave components of the Earth's radiation field at about 40 km resolution. It is essential that these measurements be accurately located at the top of the Earth's atmosphere so they can be properly interpreted by users of the data. Before the launch of the ERBE instrument sets, a substantial emphasis was placed on understanding all factors which influence the determination of measurement locations and properly modeling those factors in the data processing system. After the launch of ERBE instruments on the Earth Radiation Budget Satellite and NOAA 9 spacecraft in 1984, a coastline projection method was developed to assess the accuracy of the algorithms and data used in the location calculations. Using inflight scanner data and the coastline detection technique, the measurement location errors are found to be smaller than the resolution of the scanner instruments. This accuracy is well within the required location knowledge for useful science analysis. Author

89 ASTRONOMY

Includes radio, gamma-ray, and infrared astronomy, and astrometry.

N87-28472 Cornell Univ., Ithaca, N.Y.
A VERY DEEP FAR-INFRARED SURVEY Ph.D. Thesis
Perry B. Hacking 1987 219 p
Avail: Univ. Microfilms Order No. DA8708882

A deep far-infrared survey is presented using over 1000 scans made of a 4 to 6 deg(2) field at the north ecliptic pole by the Infrared Astronomy Satellite (IRAS). The point-source sample is up to 100 times fainter than the IRAS Point Source Catalog at 12 and 25 microns; and ten times fainter at 60 microns. Moving and spurious sources do not contaminate the point-source sample. The 12 and 25 micron surveys are detector-noise-limited. The 60 micron survey is confusion-limited. The slope of the 12 micron star count distribution is consistent with that predicted by the Bahcall and Soneira Standard Galaxy Model. The total number of stars detected at 12 microns is consistent with a 270 +/- 20 pc scale height for disk giants. There are no isolated brown dwarfs in the 12 micron sample. This fact implies a local mass density of brown dwarfs of less than or = 1 solar mass pc(-3), a factor of ten higher than the Oort mass density. The 60 micron galaxy counts are inconsistent with a nonevolving, uniformly distributed universe. The 60 micron source counts can be explained by the luminosity function if evolving at approx. 20% per billion years ago or if there is a cluster at a redshift of approx. 0.1 in this direction. Dissert. Abstr.

N87-28473# European Space Agency, Paris (France).
THE HIGH THROUGHPUT X-RAY SPECTROSCOPY MISSION. REPORT OF THE TELESCOPE WORKING GROUP
B. Aschenbach, O. Citterio, J. M. Ellwood, P. Jensen, P. deKorte, A. Peacock, and R. Willingale Feb. 1987 52 p
(ESA-SP-1084; ISSN-0379-6566; ETN-87-90154) Copyright Avail: NTIS HC A04/MF A01

The design of a spaceborne X-ray telescope with spatial resolution less than 30 arc sec HEW, and effective area 10,000 sqcm at 2 keV; 5 000 sqcm at 8 keV is discussed. Optical design studies indicate that for ideal telescopes the spatial resolution can be met. The effective area is achieved with 5, 7, and 12 telescope modules for conical, Wolter-1, and Kirkpatrick-Baez designs, respectively. The production, assembly, and alignment techniques were reviewed. The use of 7 Wolter-1 telescopes, each with a focal length of 8 m and an aperture diameter of 70 cm is recommended. The Kirkpatrick-Baez design was not accepted because at least 12 telescope modules would be required. The conical design was rejected because it would not meet the spatial resolution requirement. The Wolter-1 telescopes have to be manufactured by replication techniques, similar to those used for EXOSAT. For the X-ray Spectroscopy Mission these techniques require appreciable further development, particularly for the production of the lightweight Wolter-1 replica optics. ESA

N87-28474 Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
THE FOCAL PLANE INSTRUMENTATION OF THE ROSAT TELESCOPE
E. Pfeffermann, U. G. Briel, H. Hippmann, G. Kettenring, G. Metzner, P. Predehl, G. Reger, K.-H. Stephan, M. V. Zombeck, and J. Chappell (Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.) et al. Feb. 1987 25 p Presented at the Society for Photo-Optical Instrumentation Engineers (SPIE), Berlin, West Germany, Dec. 1986
(MPE-Preprint-81; ISSN-0178-0179; ETN-87-90315) Copyright Avail: Fachinformationszentrum, Karlsruhe, West Germany

The ROSAT focal plane instrumentation and X-ray image converters are described. The ROSAT telescope is equipped with two different kinds of X-ray image converters: two redundant position sensitive proportional counters (PSPC) and one high resolution imager (HRI), based on microchannel plates. The detectors and part of their front end electronics as well as the gas supply system for the PSPC's are mounted onto a carousel, which allows positioning of the desired imager in the focus of the telescope. All instruments, electronics, mechanisms, etc., are accommodated in the focal plane housing, which is mounted on the optical bench of the mirror system. Compared with previous X-ray satellite missions, the ROSAT all sky survey will be 2 to 3 orders of magnitude deeper. About 100,000 new sources will be discovered and located with an accuracy of 1 arc min or better. In the pointed mode, the ROSAT mirror - PSPC combination sensitivity to point sources is a factor 5 greater than the EINSTEIN imaging proportional counter. ESA

N87-28475 Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
SOFT X-RAY OBSERVATIONS OF THE RADIO PULSAR PSR 1055-52
W. Brinkman and H. Oegelman Jan. 1987 13 p Submitted for publication Sponsored by Deutsche Forschung Gemeinschaft
(MPE-Preprint-82; ETN-87-90316) Copyright Avail: Fachinformationzentrum, Karlsruhe, West Germany

The radio pulsar PSR1055-52 was observed by EXOSAT for 100,000 secs. The data can be fitted best with blackbody spectra with temperatures of 500,000 to 800,000 K. The obtained temperatures are consistent with models for the initial cooling of neutron stars. ESA

N87-28476# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ON THE STABILITY OF THE 13.2 MIN OSCILLATION OF V1223 SAGITTARII
F. Jablonski and J. E. Steiner Apr. 1987 29 p Prepared in cooperation with Instituto de Pesquisas Espaciais, Sao Paulo (Brazil). Submitted for publication
(INPE-4153-PRE/1058) Avail: NTIS HC A03/MF A01

Partial results of a photometric program covering seven consecutive observational seasons on the intermediate polar V1223 SGR are reported. It was found that the period of the 13.2 min oscillation of V1223 SGR increased with a time derivative P(.) = +2.8 x 10 to the -11 since its discovery. An improved ephemeris is also obtained for predicting the times of maximum light of the orbital modulation. Some possible alternatives for the structure of the system are discussed. Author

N87-28477# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Dept. of Astrophysics.
PROFILES OF EMISSION LINES IN AGN. PART 1: OBSERVATIONS OF (OIII) LINES
Ivo C. Busko and J. E. Steiner Mar. 1987 27 p Submitted for publication
(INPE-4144-PRE/1051) Avail: NTIS HC A03/MF A01

Presented are high resolution (35 km/sec) spectroscopic observations of the (OIII) lambda 4959/5007 emission lines in 13 southern active galactic nuclei. Profile measures are presented and compared with measures from other authors, obtained with different resolutions. We also show the very unusual (OIII) lambda 5007 profile of NGC7213, which shows two very distinct components, a narrow one being attributable to a classical Narrow Line Region, and a very wide one which may have originated in a region characteristic of LINERs. Author

90 ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.
For related information see also *75 Plasma Physics*.

N87-28478 Virginia Univ., Charlottesville.
FORMALDEHYDE OBSERVATIONS OF MOLECULAR CLOUDS Ph.D. Thesis
Edward James Wadiak 1986 134 p
Avail: Univ. Microfilms Order No. DA8705679

The 1(11) to 1(10) and 2(12) to 2(11) K-doublet transitions H2CO have been observed in absorption towards 26 strong continuum radio sources in the first galactic quadrant. Ninety-seven discrete absorption components have been detected in the 6 cm 1(11) to 1(10) line. Of these, 69 have corresponding detections in the 2 cm 2(12) to 2(11) transition. The data were analyzed using a 16-level collisional excitation model and the collisional rate coefficients of Green et al. (1978), employing a spherically symmetric Large Velocity Gradient approximation to treat the radiative transfer. Median H2 densities of 9 x 10(4) cm(-3) were obtained for clouds near H II regions and 7 x 10(4) cm(-3) for clouds well removed from H II regions. Estimates of the ortho-H2CO column density, when combined with conservative estimates of the ortho-H2CO abundance, suggest that the H2CO traces a significant fraction (20 to 80%) of the total H2 column density seen in CO. No evidence is found in our data sample for the existence of a significant population of molecular clouds comprised solely of low density gas. Maps of the 6 cm and 2 cm H2CO absorption in the dense molecular core TMC-1 and high spatial resolution observations of the 2 cm H2CO emission in the rho Oph B cloud core are also presented. Dissert. Abstr.

N87-28479# Stanford Linear Accelerator Center, Calif.
NON-LINEAR SIGMA-MODELS AND STRING THEORIES
A. Sen Oct. 1986 17 p Presented at the Summer Workshop on High Energy Physics and Cosmology, Trieste, Italy, 30 Jun. 1986
(Contract DE-AC03-76SF-00515)
(DE87-003268; SLAC-PUB-4136; CONF-8606312-1) Avail: NTIS HC A02/MF A01

The connection between sigma-models and string theories is discussed, as well as how the sigma-models can be used as tools to prove various results in string theories. Closed bosonic string theory in the light cone gauge is very briefly introduced. Then, closed bosonic string theory in the presence of massless background fields is discussed. The light cone gauge is used, and it is shown that in order to obtain a Lorentz invariant theory, the string theory in the presence of background fields must be described by a two-dimensional conformally invariant theory. The resulting constraints on the background fields are found to be the equations of motion of the string theory. The analysis is extended to the case of the heterotic string theory and the superstring theory in the presence of the massless background fields. It is then shown how to use these results to obtain nontrivial solutions to the string field equations. Another application of these results is shown, namely to prove that the effective cosmological constant after compactification vanishes as a consequence of the classical equations of motion of the string theory. DOE

N87-28480# Florida Univ., Gainesville. Dept. of Physics.
ON THE EVOLUTION OF GLOBAL STRINGS IN THE EARLY UNIVERSE
D. Harari and P. Sikivie 1987 13 p
(Contract DE-FG05-86ER-40272)
(DE87-008766; DOE/ER-40272/32; UFTP-87-4) Avail: NTIS HC A02/MF A01

It is found that a bent global string straightens itself out by dissipation into Nambu-Goldstone (NG) bosons in the order of one oscillation time and that the spectrum of radiated NG bosons is 1/k. In the early universe, the assumption that there is one global string per causal horizon is justified after an initial period during which the effect of the primordial plasma on the motion of the strings is non-negligible. We find that the upper bound that axion radiation by strings places on the axion decay constant is comparable to, but not more stringent than the one derived from coherent oscillations of the axion field, i.e., f(sub a) less than or approximately equal to 10 to the 12th power GeV. We also discuss the model-dependence of this bound. DOE

N87-28481# Fermi National Accelerator Lab., Batavia, Ill.
INFLATION IN THE UNIVERSE
M. S. Turner May 1987 28 p Presented at the Workshop on Superstrings, Composite Structures, and Cosmology, College Park, Md., 11 Mar. 1987 Prepared in cooperation with Chicago Univ., Ill.
(Contract DE-AC02-76CH-03000)
(DE87-010909; FNAL/C-87/86-A; CONF-8703143-1) Avail: NTIS HC A03/MF A01

The big bang cosmology is a highly successful model, providing a reliable and tested accounting of the Universe from 0.01 sec after the bang until today, some 15 Gyr later. However, very special initial data seem to be required in order to account for the observed smoothness and flatness of our Hubble volume and for the existence of the small primeval density inhomogeneities required for the formation of structure in the Universe. Inflation offers a means of accounting for these special initial data, which is based on physics at sub-planck energy scales (much less than m(sub pl) approx. = 10 to the 19th power GeV) and is motivated by contemporary ideas in particle theory. Here the status of the Inflationary Paradigm is reviewed. At present essentially all inflationary models involve a very weakly-coupled (quantified by the presence of a dimensionless parameter of order 10 to the -12 or so) scalar field which is displaced from the minimum of its potential. Regions of the Universe where the scalar field is initially displaced from its minimum undergo inflation as the scalar field relaxes, resulting in a Universe today which resembles ours in regions much larger than our present Hubble volume (approx. = 10 to the 28 cm), may be highly irregular. The most conspicuous blemish on the paradigm is the lack of a compelling particle physics model to implement it. Also reviewed are some other unresolved issues, and the all important confrontation between inflation and observational data is fully discussed. Finally, the possibility that inflation leads to large-scale, primeval magnetic fields of sufficient strength to be of astrophysical interest is covered. DOE

N87-28482# Fermi National Accelerator Lab., Batavia, Ill.
COSMIC STRINGS IN AN EXPANDING SPACETIME
J. A. Stein-Schabes and A. B. Burd Apr. 1987 27 p Prepared in cooperation with Sussex Univ., Brighton, England
(Contract DE-AC02-76CH-03000)
(DE87-010939; FNAL/Pub-87/77-A) Avail: NTIS HC A03/MF A01

The stability of a static, infinitely long and straight vacuum string solution under inhomogeneous axisymmetric time-dependent perturbations is investigated. It is found to be perturbatively stable. The work is further extended by finding a string solution in an expanding Universe. The back reaction of the string on the gravitational field has been ignored. The background is assumed to be a Friedman-Robertson-Walker (FRW) cosmology. By numerically integrating the field equations in a radiation and matter dominated model, oscillatory solutions are discovered. The possible

damping of these oscillations is discussed. For late times the solution becomes identical to the static one studied earlier. DOE

N87-28483 Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
NEUTRON STAR PRECESSION AND THE DYNAMICS OF THE SUPERFLUID INTERIOR
Ali Alpar and Hakki Oegelman Jan. 1987 27 p Submitted for publication Sponsored in part by Deutsche Forschung Gemeinschaft
(Grant NATO-RG-186-81)
(MPE-Preprint-80; ETN-87-90314) Copyright Avail: Fachinformationszentrum, Karlsruhe, West Germany

Euler's equations were formulated with models of internal torques to show that the superfluid interior of Her X1 has steady states in which the interior follows the crust's precisions. The steady state of the core superfluid is determined by the internal torque on it which is linear in the lag between the rotation rates of the superfluid and the crust. The pinned crust superfluid also takes part in the precession through vortex creep; the constraint of absolute pinning is never operative because a steady state exists in the regime where the creep rate is linear in the lag between the pinned superfluid and the crust. Internal torques do not exceed those available in the Her X-1/ HZ Her binary system. Interpreting the 35 day cycle turn-on fluctuations of Her X-1 in terms of fluctuating internal pinning torques leads to a large energy dissipation incompatible with the observations. ESA

N87-28484# Washington Univ., St. Louis, Mo. Center for the Space Sciences.
THE EARLY SOLAR SYSTEM ABUNDANCE OF 244Pu AS INFERRED FROM THE ST. SEVERIN CHONDRITE
G. B. Hudson, B. M. Kennedy, F. A. Podosek, and C. M. Hohenberg Mar. 1987 37 p Presented at the Lunar and Planetary Science Conference, Houston, Tex., 16 Mar. 1987
(Contract W-7405-eng-48)
(DE87-010811; UCRL-96725; CONF-870396-2) Avail: NTIS HC A03/MF A01

We describe the analysis of Xe released in stepwise heating of neutron-irradiated samples of the St. Severin chondrite. This analysis indicates that at the time of formation of most chondritic meteorites, approximately 4.56 x 10 to the 9th power years ago, the atomic ratio of Pu-244/U-238 was 0.0068 +/- 0.0010 in chondritic meteorites. It is believed that this value is more reliable than that inferred from earlier analyses of St. Severin. It is felt that this value is currently the best available estimate for the early solar system abundance of Pu-244. DOE

N87-28485# Stanford Linear Accelerator Center, Calif.
TWO EXERCISES IN SUPERSYMMETRY: A LOW-ENERGY SUPERGRAVITY MODEL AND FREE STRING FIELD THEORY Ph.D. Thesis
Christian Richard Preitschopf Sep. 1986 48 p
(Contract DE-AC03-76SF-00515)
(SLAC-301) Avail: NTIS HC A03/MF A01

The supersymmetric standard model is studied in the presence of heavy families. The minimal set of Higgs fields, the desert between the electroweak and the grand unification scale and perturbative values of the dimensionless parameters throughout this region are assumed. Using the numerical as well as the approximate analytic solution of the renormalization group equations, the evolution of all the parameters of the theory in the case of large Yukawa couplings for the fourth family was studied. The desired spontaneous symmetry breaking of the electroweak symmetry takes place only for a rather unnatural choice of the initial values of certain mass parameters at the grand unification scale. Two scenarios are possible, depending on the value of the gravitino mass. The gauge-invariant theory of the free bosonic open string is generalized to treat closed strings and superstrings. All of these theories can be written as theories of string differential forms defined on suitable spaces. All of the bosonic theories have exactly the same structure; the Ramond theory takes an analogous first-order form. It is shown explicitly, using simple and general manipulations, how to gauge-fix each action to the light-cone gauge and to the Feynman-Seigel gauge. Author

N87-28486# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
A STUDY OF HARD X-RAY ASSOCIATED METER-DECAMETER BURSTS OBSERVED ON DECEMBER 19, 1979
M. R. Kundu, T. E. Gergely, S. R. Kane (California Univ., Berkeley.), and H. S. Sawant Jul. 1987 14 p Previously announced in IAA as A86-42848
(INPE-4266-PRE/1139) Avail: NTIS HC A02/MF A01

The results of a study of the relationship of a complex meter-decameter wavelength radio burst observed with the Clark Lake E-W and N-S interferometers, with a hard X-ray burst observed with the X-ray spectrometer aboard ISEE-3 are presented. The radio burst consisted of several type III's, reverse drift type III's, a U burst, and type II and type IV bursts. The X-ray emission was also complex. The radio as well as hard X-ray emissions were observed before the flash phase of the flare; they were not always associated and it is conjectured that this may constitute evidence for acceleration of electrons high in the corona. On the other hand, all components of the reverse drift burst were associated with hard X-ray subpeaks, indicating multiple injection of electron beams along field lines with different density gradients. While the type II burst appeared to be related to the hard X-ray burst, a detailed correspondence between individual features of the radio and hard X-ray burst emissions could not be found. The type IV burst started after all hard X-ray emissions ceased. Its source appeared to be a magnetic arch, presumably containing energetic electrons responsible for the gyrosynchrotron radiation of type IV. Author

N87-28487# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
OBSERVATIONS OF AMMONIA IN GALACTIC HII REGIONS
J. W. S. VilasBoas, E. Scalise, Jr., and J. L. MonteirodoVale May 1987 20 p Submitted for publication
(INPE-4176-PRE/1070) Avail: NTIS HC A02/MF A01

The ammonia emission associated with galactic HII regions were studied. Some physical parameters, computed for each individual sources, were derived and a brief discussion follows. Author

N87-27689# Joint Publications Research Service, Arlington, Va.
SCIENTIFIC DIRECTOR OF INTERSHOCK PROJECT ON PROGNOZ-10 RESULTS
Albert Galeyev *In its* USSR Report: Space 21 Apr. 1986 p 33-36 Transl. into ENGLISH from APN: Advances of Science and Technology (Moscow, USSR), no. 22, 20 Nov. 1985 p 1-5
(For primary document see N87-27687 22-12)
Avail: NTIS HC A07/MF A01

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance.*

N87-28488*# Missouri Univ., St. Louis. Dept. of Physics.
CONDENSATE PHENOMENA IN THE POLAR REGIONS OF MARS Final Report, 25 Apr. 1985 - 24 Apr. 1987
Philip B. James Apr. 1987 9 p
(Grant NAGw-742)
(NASA-CR-181231; NAS 1.26:181231) Avail: NTIS HC A02/MF A01 CSCL 03B

Models used to study the changes in Martian climate must of necessity adequately describe the current volatile cycles. The focus is on mathematical modeling of current volatile cycles and modest extrapolation to past regimes. Water cycle, dust storms, polar variabilty, and north polar clouds data were compared to the model predictions. B.G.

N87-28489# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Inst. for Space Research.
NONLINEAR GENERATION OF THE fp RADIATION UPSTREAM OF PLANETARY BOW SHOCKS
Abraham Chian Long Chian Jun. 1987 5 p Prepared for presentation at the AGU Chapman Conference on Plasma Waves and Instabilities in Magnetospheres and at Comets, Sendai, Japan, Oct. 1987
(Contract FINEP-537/CT)
(INPE-4193-PRE/1077) Avail: NTIS HC A02/MF A01

The generation mechanism of the fundamental radiation upstream of planetary bow shocks is studied. It is shown that intense electron plasma waves can generate coherent radiation near the fundamental electron plasma frequency through the following parametric processes: (1) electromagnetic decay/fusion instabilities; (2) double electromagnetic decay/fusion instabilities; and, (3) electromagnetic oscillating two-stream instabilities. Calculation of the nonlinear growth rate and threshold, using the spacecraft data, indicates that these electromagnetic parametric instabilities are likely sources of the f sub p radiation in the foreshock region. Author

N87-28490*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PRELIMINARY SCIENTIFIC RATIONALE FOR A VOYAGE TO A THOUSAND ASTRONOMICAL UNITS
M. I. Etchegaray, comp. 15 May 1987 31 p
(Contract NAS7-918)
(NASA-CR-181324; JPL-Publ-87-17; NAS 1.26:181324) Avail: NTIS HC A03/MF A01 CSCL 03B

A proposed mission to 1000 astronomical units (TAU) is under study by the Jet Propulsion Laboratory. Launch date for a TAU mission is likely to be well into the first decade of the 21st century. Study of TAU has focused on the technologies required to carry out this ambitious mission and the identification of preliminary scientific rationale for such a deep space flight. A 1-MW nuclear-powered electric propulsion (NEP) system forms the baseline method for achieving the high velocities required. A solar system escape velocity of 106 km/s is needed to propel the TAU vehicle to 1000 AU in 50 years. The NEP system must accelerate the vehicle for about ten years before this velocity is attained because of the extremely low thrust nature of the xenon-fueled ion engines. At the end of the thrusting phase the NEP system is jettisoned to allow the TAU spacecraft and science experiments to coast out to 1000 AU. Another important technology for TAU is advanced optical communication systems, which are envisioned for transmitting science data to Earth. A 1-m optical telescope combined with a 10-W laser transponder can transmit 20 kbps to a 10-m Earth-orbit-based telescope from 1000 AU. Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

For related information see *93 Space Radiation.*

N87-28491*# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.
QUANTIFICATION OF OBSERVED FLARE PARAMETERS IN RELATION TO A SHEAR-INDEX AND VERIFICATION OF MHD MODELS FOR FLARE PREDICTION Semiannual Report, 26 Mar. - 26 Sep. 1987
S. T. Wu Aug. 1987 98 p
(Grant NAG8-053)
(NASA-CR-180277; NAS 1.26:180277) Avail: NTIS HC A05/MF A01 CSCL 03B

The goal for the SAMEX magnetograph's optical system is to accurately measure the polarization state of sunlight in a narrow spectral bandwidth over the field of view of an active region to make an accurate determination of the magnetic field in that region. The instrumental polarization is characterized. The optics and coatings were designed to minimize this spurious polarization introduced by foreoptics. The method developed to calculate the insirumental polarization of the SAMEX optics is described. B.G.

N87-28492# Tennessee Technological Univ., Cookeville.
DEVELOPMENT AND APPLICATION OF THREE-DIMENSIONAL TIME-DEPENDENT MAGNETOHYDRODYNAMIC NUMERICAL MODEL
S. M. Han Mar. 1987 116 p
(Contract NA85RA-C-05068)
(PB87-182028) Avail: NTIS HC A06/MF A01 CSCL 03B

Modifications and implementations to the steady, three-dimensional MHD solar wind model (STDSOL) and to the unsteady, three-dimensional MHD solar wind model (UTDSOL) are completed. These models are appropriate for steady and time-dependent simulations of interplanetary disturbances between 18 solar radii and 1 AU. Example computations for both steady and transient cases were made to examine the capabilities of these models. In addition to two MHD models, a transient one-dimensional hydrodynamic transonic numeric model (TOH) was completed. The model is capable of simulating solar wind expansions through the hydrodynamic critical point. Example computations were performed for thermally-conductive solar wind between the solar surface and 1 AU. GRA

N87-28493*# Colorado Univ., Boulder.
EXPLORATION OF THE SOLAR-STELLAR CONNECTION AT HIGH SPECTRAL RESOLUTION WITH THE ULTRAVIOLET SPECTROMETER AND POLARIMETER, AND STUDIES OF THERMAL BIFURCATION AT THE PHOTOSPHERE-CHROMOSPHERE INTERFACE Final Report
[1987] 7 p
(Grant NAGw-740)
(NASA-CR-181295; NAS 1.26:181295) Avail: NTIS HC A02/MF A01 CSCL 03B

The dynamics of high-excitation plasma in the 100,000 K transition zones of stars of late spectral type, as observed with the International Ultraviolet Explorer, was compared with the radial gas velocities of individual structural features of the solar TZ, as observed with high spatial resolution by the UVSP on the Solar Maximum Mission. The 4th-positive system of carbon monoxide in the quiet sun and in active regions was studied in order to explore the properties of thermal inhomogeneities at the critical interface between the photosphere and chromosphere. B.G.

N87-28494# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
INTERPRETATION OF FAST RIPPLE STRUCTURE IN SOLAR IMPULSIVE BURSTS
J. M. Loran, J. C. Brown (Glasgow Univ., Scotland), E. Correia, and P. Kaufmann Jul. 1987 13 p Previously announced in IAA as A86-10213
(INPE-4265-PRE/1138) Avail: NTIS HC A02/MF A01

The hypothesis that solar impulsive bursts are comprised of quasi-quantized ultrarapid pulses convoluted with a variable pulse repetition rate R(t) is investigated by comparison of typical observations with numerical simulations. It is found that the ripple amplitude at burst peak increases rapidly with increase in the ratio delta-t/T of pulse separation to pulse width. Consequently, pulse widths T are generally much larger than the observed period delta-t of small amplitude ripples. It is also found that, in order to give a ripple amplitude of at least a few percent at burst peak together with reasonable burst rise and fall times without unreasonable ripple amplitude during rise and fall, the individual pulse shape must be sharply peaked but have substantial wings while the repetition rate R(t) must fall gradually away from its peak value cut off rapidly in its wings. As a specific example, a simulation is presented of the fast ripple structures observed in the impulsive 22 GHz burst of December 18, 1980. The relevance of these conclusions to physical modeling is briefly discussed. Author

N87-28495# Naval Observatory, Washington, D.C.
TOTAL SOLAR ECLIPSE OF 17-18 MARCH 1988

Alan D. Fiala, John A. Bangert, and William T. Harris 17 Mar. 1987 43 p
(AD-A181881; NOBS-CIRC-172) Avail: NTIS HC A03/MF A01 CSCL 03A

It is a continuing policy of the Nautical Almanac Office to prepare issues of the series of Naval Observatory Circulars containing detailed information for observing most total solar eclipses and some annular solar eclipses. This is a service to the international scientific community, based on agreements with Commissions and Working Groups of the International Astronomical Union. A total eclipse of the Sun will occur on Thursday, 17 March and Friday, 18 March 1988. It will be preceded by an associated short partial eclipse of the Moon on 3 March. The duration of totality of the solar eclipse will approach 4 minutes at maximum, the longest since 11 June 1983. Not much of the path is over land. First landfall will occur just after sunrise at the west coast of Sumatra, at Oh 28m U.T. The track will cross Sumatra in three minutes, with the umbral shadow growing so as to increase both the width of the path and the duration of totality. Palembang lies near the central line, and is probably one of the most accessible such places. Bangka Island, just off the east coast of Sumatra, is relatively flat and a mining area. The path will reach Borneo at Oh 36m U.T. with the umbral shadow continuing to expand. It will take approximately 13 minutes to cross the island, and the track will lie completely within Indonesian territory on Borneo. The other major land mass in the path of totality is the southern tip of Mindanao. GRA

N87-28496# National Center for Atmospheric Research, Boulder, Colo.
THE Fe 15 SOLAR CORONA AT 5303 ANGSTROMS: AN ATLAS OF SYNOPTIC CHARTS FROM THE SACRAMENTO PEAK CORONAL PHOTOMETER, MAY 1973-DECEMBER 1985
R. C. Altrock, L. B. Gilliam, D. G. Sime, and R. R. Fisher Jun. 1987 168 p
(AD-A181938; NCAR/TN-276-STR; AFGL-TR-87-0162) Avail: NTIS HC A08/MF A01 CSCL 03A

Synoptic photoelectric observations of the solar corona in the emission from the green line (5303A) of Fe 15 were begun at the Sacramento Peak Observatory in June 1973 and continue to the present. The observations made during this program provide a record of the distribution and brightness of the hotter regions of the corona (1,800,000 K) over an entire solar cycle. As such, the green line data may provide a link between the active regions of the chromosphere and the large scale structure of the corona. In order to allow comparison of these data with other observations of the Sun and corona, we present here an atlas of the green line measurements in the same format as that used to display the white light coronal structure recorded by the High Altitude Observatory's K-coronameters on Mauna Loa, in previously published atlases. It is our intent that this atlas be brought up to date periodically as the observations permit. GRA

93 SPACE RADIATION

Includes cosmic radiation; and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N87-28497 Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
MAP OF THE GALACTIC CENTER IN THE 1.8 MeV Al26 GAMMA RAY LINE
P. vonBallmoos, R. Diehl, and V. Schoenfelder Jan. 1987 34 p Submitted for publication Original contains color illustrations
(MPE-Preprint-79; ETN-87-90313) Copyright Avail: Fachinformationszentrum, Karlsruhe, West Germany

During a balloon flight with a Compton telescope, the 1.809 MeV gamma ray line from radioactive Al26 was detected, when the galactic center came into the field-of-view. Most of the emission comes from the region of the galactic center. The image is consistent with a point source origin at the galactic center, although a diffuse origin of the gamma-ray line in interstellar space from unresolved candidate sources like supernovae, novae, Wolf-Rayet stars, or red giants, is possible. The gamma-ray line fluxes are higher by 1.5 to 2 sigma than those obtained with Ge-spectrometers. Giant explosive event(s) in the center of the galaxy within the last few million yr are an alternative possibility for the origin of the gamma-ray line as opposed to the generally assumed origin in interstellar space. ESA

N87-28498# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Inst. for Space Research.
A THEORY FOR THE FUNDAMENTAL RADIATION OF INTERPLANETARY TYPE 3 RADIO BURSTS
Abraham C.-L. Chian and Maria V. Alves Jun. 1987 19 p Submitted for publication
(Contract FINEP-537/CT)
(INPE-4194-PRE/1078) Avail: NTIS HC A02/MF A01

A new generation mechanism of interplanetary type III radio bursts at the fundamental electron plasma frequency is discussed. It is shown that the electromagnetic oscillating two-stream instability, driven by two oppositely propagating Langmuir waves, can account for the experimental observations. In particular, the major difficulties encountered by the previously considered electromagnetic decay instability are removed. Author

N87-28499# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
LOW-ENERGY GAMMA RAYS FROM PULSAR GX 1+4 BALLOON RESULTS
U. B. Jayanthi, F. Jablongski, and J. Braga Mar. 1987 20 p Submitted for publication
(INPE-4139-PRE/1047) Avail: NTIS HC A02/MF A01

The results from a search of pulsed emissions in low-energy gamma rays from GX 1+4 source observed during zenith transit in a balloon experiment in April, 1982 are presented. The observed pulsar period is 120.6 + or - 0.2 seconds with pulsed emission flux of approximately (1.3 + or - 0.4) X .00001 photons/sq cm/s KeV sup -1 at an average enemy approximately 342 KeV. These pulsations, observed at gamma ray energies for the first time from any X-ray pulsar, in conjunction with the period determined in X-ray, indicate a spin-down in contrasts with the spin-up behavior observed by others at earlier epochs. Author

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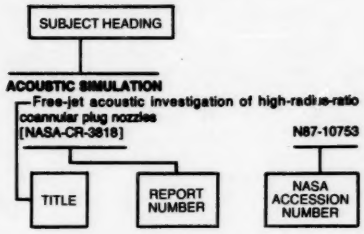

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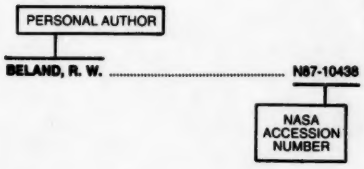

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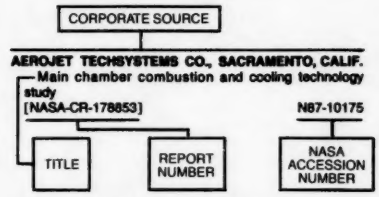

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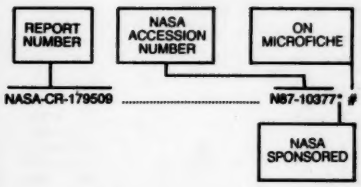

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B8701680 ..... N87-28113 #
B8707427 ..... N87-27731 #
B8707428 ..... N87-27764 #
B8707430 ..... N87-27716 #
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B8707439 ..... N87-28041 #
B8707448 ..... N87-27733 #
B8707453 ..... N87-27736 #
B8707456 ..... N87-27953 #
B8707458 ..... N87-28051 #
B8707459 ..... N87-27656 #
B8707461 ..... N87-28052 #
B8707463 ..... N87-28053 #
B8707464 ..... N87-28054 #
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CONF-870263-SUMM ..... N87-28167 #
CONF-870388-9 ..... N87-27801 #

CONF-870388-10 ..... N87-27800 #
CONF-870396-2 ..... N87-28484 #
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CONF-870519-3 ..... N87-27749 #
CONF-870541-1 ..... N87-27751 #
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CONF-870623-5 ..... N87-27992 #
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CONF-870755-1 ..... N87-28014 #
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CONF-870804-1 ..... N87-28174 #
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CONF-8610286-1-SUMM ..... N87-27814 #
CONF-8703127-1 ..... N87-28015 #
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CONF-8705118-1 ..... N87-27996 #
CONF-8706104-2 ..... N87-27630 #
CONF-8706123-2 ..... N87-28050 #
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DE87-003268 ..... N87-28479 #
DE87-003456 ..... N87-27765 #
DE87-004344 ..... N87-28283 #
DE87-004909 ..... N87-27879 #
DE87-005020 ..... N87-27896 #
DE87-005065 ..... N87-27897 #
DE87-005206 ..... N87-28375 #
DE87-005327 ..... N87-27898 #
DE87-005842 ..... N87-27899 #
DE87-005848 ..... N87-27900 #
DE87-005849 ..... N87-28061 #
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DE87-006122 ..... N87-28173 #
DE87-006334 ..... N87-28167 #
DE87-007004 ..... N87-28404 #
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DE87-007084 ..... N87-28034 #
DE87-007085 ..... N87-28035 #
DE87-007679 ..... N87-28393 #
DE87-007899 ..... N87-28009 #
DE87-008493 ..... N87-27937 #
DE87-008766 ..... N87-28480 #
DE87-008843 ..... N87-27751 #
DE87-008846 ..... N87-27630 #

DE87-008929 ..... N87-28170 #
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DE87-009118 ..... N87-27766 #
DE87-009197 ..... N87-27797 #
DE87-009289 ..... N87-28174 #
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DE87-009503 ..... N87-27914 #
DE87-009559 ..... N87-27767* #
DE87-009681 ..... N87-28175 #
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DE87-009825 ..... N87-28434 #
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DE87-009968 ..... N87-28060 #
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DE87-010037 ..... N87-27980 #
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DE87-010060 ..... N87-28405 #
DE87-010066 ..... N87-27718 #
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DE87-010115 ..... N87-27768 #
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DE87-010348 ..... N87-28176 #
DE87-010400 ..... N87-27796 #
DE87-010512 ..... N87-28460 #
DE87-010532 ..... N87-27679 #
DE87-010689 ..... N87-28217 #
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DE87-010820 ..... N87-28284 #
DE87-010838 ..... N87-27938 #
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DE87-010939 ..... N87-28482 #
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DE87-011064 ..... N87-27960 #
DE87-011066 ..... N87-27799 #
DE87-011089 ..... N87-27769 #
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DFVLR-FB-86-05 ..... N87-27939 #
DFVLR-FB-86-06 ..... N87-27940 #
DFVLR-FB-86-07 ..... N87-27618 #
DFVLR-FB-86-09 ..... N87-28332 #
DFVLR-FB-86-13 ..... N87-28254 #
DFVLR-FB-86-18 ..... N87-27729 #
DFVLR-FB-86-20 ..... N87-28255 #
DFVLR-FB-86-21 ..... N87-27664 #
DFVLR-FB-86-23 ..... N87-27676 #

DFVLR-FB-86-26 ..... N87-27868 #

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DOE/ER-25014/1 ..... N87-28276 #
DOE/ER-25026/7 ..... N87-28284 #
DOE/ER-40073/T2 ..... N87-28436 #
DOE/ER-40272/32 ..... N87-28480 #
DOE/ER-45155/3 ..... N87-27769 #
DOE/ER-45257/1 ..... N87-28049 #
DOE/ER-53205/T2 ..... N87-28420 #
DOE/ER-60397/H2 ..... N87-28217 #

DOE/ET29372-7 ..... N87-27990* #

DOE/ID-10171 ..... N87-28030 #

DOE/JPL-956985/1 ..... N87-27767* #

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DOT/FAA-PM-87/6 ..... N87-28233 #

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DOT/FAA/CT-86/23 ..... N87-27818 #

DOT/FAA/PM-86/41 ..... N87-28256 #
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DOT/FAA/PM-87/12 ..... N87-28232* #

DP-MS-86-151 ..... N87-27772 #
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DRL-LI81-VOL-2 ..... N87-28286* #
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DRL-LI81-VOL-7 ..... N87-28291* #
DRL-LI81-VOL-8 ..... N87-28292* #
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ECN-19 ..... N87-28406 #
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ECN-192 ..... N87-27762 #
ECN-193 ..... N87-27763 #
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ED/84-450/GCM ..... N87-27730 #

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EOARD-TR-87-06 ..... N87-27754 #

EPA/IMSD-85/003 ..... N87-28458 #

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ESA-CR(P)-2328-VOL-1 ..... N87-27724 #
ESA-CR(P)-2328-VOL-2 ..... N87-27725 #
ESA-CR(P)-2328-VOL-3 ..... N87-27792 #
ESA-CR(P)-2328-VOL-4 ..... N87-27793 #
ESA-CR(P)-2331 ..... N87-27866 #
ESA-CR(P)-2336 ..... N87-28469 #
ESA-CR(P)-2337 ..... N87-27703 #
ESA-CR(P)-2338 ..... N87-27698 #
ESA-CR(P)-2347 ..... N87-28260 #
ESA-CR(P)-2349 ..... N87-27715 #
ESA-CR(P)-2350 ..... N87-27902 #

ESA-CR(P)-2352-VOL-1 ..... N87-28456 #
ESA-CR(P)-2352-VOL-2 ..... N87-28457 #
ESA-CR(P)-2361-VOL-1 ..... N87-27706 #
ESA-CR(P)-2361-VOL-1 ..... N87-27707 #
ESA-CR(P)-2361-VOL-2 ..... N87-27708 #
ESA-CR(P)-2361-VOL-4 ..... N87-27709 #
ESA-CR(P)-2376 ..... N87-27904 #
ESA-CR(P)-2377 ..... N87-28324 #
ESA-CR(P)-2379 ..... N87-28294 #
ESA-CR(P)-2380 ..... N87-28428 #

ESA-SP-258 ..... N87-28115 #
ESA-SP-264 ..... N87-27854 #
ESA-SP-1084 ..... N87-28473 #

ESA-TT-920 ..... N87-28218 #
ESA-TT-995 ..... N87-27939 #
ESA-TT-996 ..... N87-27940 #
ESA-TT-1000 ..... N87-27618 #
ESA-TT-1003 ..... N87-28332 #
ESA-TT-1006 ..... N87-27867 #
ESA-TT-1010 ..... N87-28254 #
ESA-TT-1013 ..... N87-27729 #
ESA-TT-1014 ..... N87-28255 #
ESA-TT-1015 ..... N87-27664 #
ESA-TT-1016 ..... N87-27676 #
ESA-TT-1022 ..... N87-27941 #
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ESD-TR-86-135 ..... N87-28445 #
ESD-TR-86-183 ..... N87-27886 #
ESD-TR-86-196 ..... N87-27701 #
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ETN-87-90005 ..... N87-27939 #
ETN-87-90006 ..... N87-27940 #
ETN-87-90007 ..... N87-27618 #
ETN-87-90008 ..... N87-28332 #
ETN-87-90009 ..... N87-27867 #
ETN-87-90010 ..... N87-28254 #
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ETN-87-90222 ..... N87-27953 #
ETN-87-90224 ..... N87-28051 #
ETN-87-90225 ..... N87-27656 #
ETN-87-90226 ..... N87-28052 #
ETN-87-90228 ..... N87-28053 #
ETN-87-90229 ..... N87-28054 #
ETN-87-90230 ..... N87-27657 #
ETN-87-90232 ..... N87-27727 #
ETN-87-90233 ..... N87-27750 #
ETN-87-90234 ..... N87-28202 #
ETN-87-90235 ..... N87-27705 #
ETN-87-90236 ..... N87-27803 #
ETN-87-90237 ..... N87-27804 #
ETN-87-90238 ..... N87-28437 #
ETN-87-90239 ..... N87-28438 #
ETN-87-90241 ..... N87-28395
ETN-87-90242 ..... N87-28336 #
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ETN-87-90320 ..... N87-28422
ETN-87-90365 ..... N87-28345 #
ETN-87-90369 ..... N87-27954 #
ETN-87-90371 ..... N87-27955 #
ETN-87-90462 ..... N87-27706 #
ETN-87-90463 ..... N87-27707 #
ETN-87-90464 ..... N87-27708 #
ETN-87-90465 ..... N87-27709 #
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ETN-87-99878 ..... N87-27725 #
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ETN-87-99880 ..... N87-27793 #
ETN-87-99883 ..... N87-27866 #
ETN-87-99985 ..... N87-28469 #
ETN-87-99986 ..... N87-27703 #
ETN-87-99987 ..... N87-27698 #
ETN-87-99994 ..... N87-28260 #
ETN-87-99996 ..... N87-27715 #
ETN-87-99997 ..... N87-27902 #
ETN-87-99998 ..... N87-28456 #
ETN-87-99999 ..... N87-28457 #

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FNAL/PUB-87/77-A ..... N87-28482 #

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FTDS/REP/0001/SAAB ..... N87-28324 #

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GIT-ICS-85/02 ..... N87-28326* #

GPO-72-663 ..... N87-27699 #

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H-1402 ..... N87-27663* #

HDL-TR-2106 ..... N87-28440 #

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ICASE-87-46 ..... N87-27961* #
ICASE-87-48 ..... N87-27956* #
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Austin, TX 78711
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